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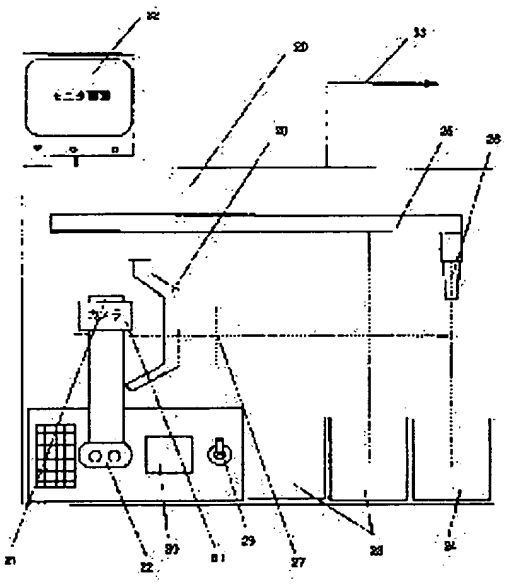
(54) MANAGING SYSTEM FOR SEMICONDUCTOR PRODUCTION PROCESS

(57)Abstract:

PROBLEM TO BE SOLVED: To perform inspection efficiently by an arrangement wherein a host means retrieving a data base upon request of record information from a terminal means and delivers the processing record of a semiconductor to the terminal means.

SOLUTION: A host means performs process check of lot in a cassette and delivers a lot ID to a wafer outer appearance inspection unit 20 if it is correct otherwise delivers an inspection recipe along with lot information. Upon receiving the information, the outer appearance inspection unit 20 informs inspection start to the host means and mounts an inspection wafer on an inspection stage 21 according to the inspection recipe. Positioning of wafer is then performed and an inspection result input section 30 acquires inspection results and a wafer image picked up by mean of a wafer inspection image camera 31. Decision of GO/NO-GO and defective category coding is made as the inspection results. The inspection results are delivered to the host means along with the wafer image. The host means stores the data in a data base. According to the system, inspection information can be grasped visually later.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] A photography means to photo the surface image of a semi-conductor, and a hysteresis input means to input the hysteresis information on semi-conductor processing, The image data area which stores the photography image obtained by the photography means, and the historical-data field which stores as text the semi-conductor processing hysteresis inputted by the hysteresis input means, It consists of the host means and terminal means which were connected with the database equipped with the table which associates these image data areas and historical-data fields through the communication line. Said host means The semi-conductor production process managerial system which outputs the processing hysteresis of the semi-conductor which searches said database and corresponds when there is enquiry of hysteresis information from said terminal means to a terminal means.
[Claim 2] The step which outputs the processing hysteresis of the semi-conductor which searches a database and corresponds to a terminal means when said host means has enquiry from said terminal means, An image information demand is received displaying said processing hysteresis on a terminal means. The semi-conductor production process managerial system according to claim 1 which carries out sequential execution of the step which said database is searched [step] and the image data corresponding to said processing hysteresis information is ****(ed) [step] when the image information demand concerned is received, and displays image data on said terminal means with said processing hysteresis information.
[Claim 3] The semi-conductor production process managerial system according to claim 1 or 2 characterized by containing the flag of whether inspection was completed in the historical data stored in said database.
[Claim 4] Said flag is a semi-conductor production process managerial system according to claim 3 characterized by the ability to rewrite with reference to the processing hysteresis and the image data which were displayed on said terminal means.
[Claim 5] Said host means is a semi-conductor production process managerial system according to claim 1 characterized by connecting by the semi-conductor conveyance system control means and the communication line, and operating a semi-conductor conveyance system according to the demand from said terminal means.
[Claim 6] Said semi-conductor production process managerial system is a semi-conductor production process managerial system according to claim 1 characterized by storing the measurement result and measurement image which were equipped with the circuit pattern dimension measuring device on the front face of a semi-conductor equipped with the **** electron microscope, and were performed through the **** electron microscope concerned as the historical data in said database, and image data.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the information management in a semi-conductor wafer process. At the process works of a semi-conductor wafer, it points to production TAT compaction and equalization production for a productivity drive.
[0002] For the purpose of said productivity drive, construction of the automation production system (CIM) which combined the production process management automatic material handling system by the information management which used the computer system also in the improvement in a semi-conductor wafer process is made in recent years.
[0003] Consequently, about the production process which performs wafer processing of the latest chip fabrication factory, it can be said that it is coming to the phase where wafer processing can be mostly performed by uninhabited.
[0004]
[Problem(s) to be Solved by the Invention] However, it is said that inspection and a measurement process are in the situation that this full automation production is uniquely unrealizable.
[0005] That is, it is also important for the inspection and measurement in a semi-conductor wafer process that an operator's activity has taken the lead and takes human being's production activity and adjustment of the wafer processing cycle in a manufacturing installation for a productivity drive.
[0006] And it is expected that this process continues to become increasingly important with detailed-izing of a wafer process. This invention is made paying attention to such a point, about the inspection and the measurement process in a semi-conductor wafer process, tends to change the gestalt of an activity and tends to raise the productivity as improvement in a wafer process.
[0007]
[Means for Solving the Problem] A photography means by which the 1st means of this invention photos the surface image of a semi-conductor, and a hysteresis input means to input the hysteresis information on semi-conductor processing, The image data area which stores the photography image obtained by the photography means, and the historical-data field which stores as text the semi-conductor processing hysteresis inputted by the hysteresis input means, It consists of the host means and terminal means which were connected with the database equipped with the table which associates these image data areas and historical-data fields through the communication line. Said host means When there is enquiry of hysteresis information from said terminal means, it is the semi-conductor production process managerial system which outputs the processing hysteresis of the semi-conductor which searches said database and corresponds to a terminal means.
[0008] By associating the processing hysteresis information and screen information of a semi-conductor on a table, and managing them, if needed, the validity of inspection can be examined, or a photography process and an inspection process can be divided in time, and an inspection process can be efficiently performed with reference to the display screen of a terminal means in another room.
[0009] The step which outputs the processing hysteresis of the semi-conductor which the 2nd means

searches a database when there is enquiry from a terminal means in said host means, and corresponds to a terminal means, An image information demand is received displaying said processing hysteresis on a terminal means. When the image information demand concerned is received, said database is searched, the image data corresponding to said processing hysteresis information is ****(ed), and sequential execution of the step which displays image data on said terminal means with said processing hysteresis information is carried out.

[0010] That is, decline in the processing effectiveness resulting from presenting of unnecessary image information can be prevented by ordering image information from a host means with reference to processing hysteresis if needed only by text on a display terminal.

[0011] The 3rd means includes the flag of whether inspection was completed in the historical data stored in said database. When a photography process and an inspection process are divided in time, the existence of inspection becomes clear with the flag concerned.

[0012] The 4th means enabled rewriting of said flag, referring to the processing hysteresis and the image data which were displayed on said terminal means. That is, after performing inspection of visual inspection etc., referring to processing hysteresis and image data on a display terminal, the direct flag was rewritten from on the display terminal.

[0013] The 5th means connects said host means by the semi-conductor conveyance system control means and the communication line, and it was made to operate a semi-conductor conveyance system according to the demand from said terminal means. Since conveyance of a wafer is controllable by the host means by making it a conveyance system interlocked with, incorporation of an automatic location ****** image is automatable.

[0014] In said 1st means, the semi-conductor production process managerial system is equipped with the circuit pattern dimension measuring device on the front face of a semi-conductor equipped with the **** electron microscope, and the 6th means stores the measurement result and measurement image which were performed through the **** electron microscope concerned as the historical data in said database, and image data.

[0015] Thus, also in a length measurement process, while the hysteresis information on measurement and the image image information of a circuit pattern can be treated to coincidence and the effectiveness of a length measurement activity improves sharply, length measurement precision can be raised.

[0016]

[Embodiment of the Invention] The operation gestalt of this invention is explained based on drawing.

[0017]

[Example 1] An approximate account Fig. in case the display screen of the lot processing activity hysteresis which drawing 1 uses the outline control schematic diagram of the production automation system in semi-conductor wafer process works and drawing 2 for the process flow Fig. of a semi-conductor wafer process, and uses drawing 3 at the time of semi-conductor manufacture, and drawing 4 perform an activity processing hysteresis display, and drawing 5 are the explanatory views showing wafer visual-inspection equipment.

[0018] In drawing 1 , 1 is a data server for semi-conductor production control, and functions as a host server which manages the whole process. That is, the data server 1 for semi-conductor production control treats the down-stream-processing procedure of each production wafer lot, processing conditions, and the collection data after wafer processing, and keeps information. Moreover, this server 1 has the database 2 which consisted of large capacity storage for said management.

[0019] It is drawing 20 which showed the configuration of said database 2. A database 2 uses a lot ID as a key, and has the index table 2001 with which the storing address of wafer historical data and the storing address of wafer image data were matched.

[0020] The processing hysteresis in a semi-conductor production process as shown in drawing 3 is stored in the wafer historical data 2002 in a database 2 as text data. Moreover, the image data on the front face of a wafer obtained in the below-mentioned visual-inspection equipment 20 grade is stored in the wafer image data 2003. Thus, the wafer historical data 2002 and the wafer image data 2003 are associated and managed by the index table 2001.

[0021] It connects with LAN3 and said data server 1 for semi-conductor production control is connected with the area computer 5 for automation which manages 1 area of a production process through the bridge 4 for communication networks in the key point at LAN3 concerned.
[0022] The display terminal 10 (refer to drawing 4) for semi-conductor production control is connected to the area computer 5 for automation through the repeater 7. Furthermore, various kinds of manufacturing installations 8, and a measurement machine and test equipment 9 are connected through the terminal server 6. Furthermore, the area computer 5 for automation is connected with the conveyance controller 11, and this conveyance controller 11 is connected to LAN for transfer controls.
[0023] In the above-mentioned system configuration, a semi-conductor wafer leads the conveyance system controlled by the conveyance controller 11, and is conveyed and transferred at a manufacturing installation 8. And wafer processing conditions are told to a manufacturing installation 8 through LAN3, a bridge 4, and a terminal server 6 by the data server 1 (host) for semi-conductor production control from the data pace 2, and processing is performed.
[0024] After the lot activity processing hysteresis information and collection data after processing termination are stored in a database 2 by the reverse root, they are used by every place which need data. After wafer processing usually conducts wafer visual inspection, and progresses to the following down stream processing. Drawing 5 shows the configuration of wafer visual-inspection equipment 20. By drawing 1 , this wafer visual-inspection equipment 20 is contained in a measurement machine and test equipment 9, and is connected to the data server 1 (host) for semi-conductor production control through the terminal server 6 grade like said above-mentioned manufacturing installation 8.
[0025] Drawing 3 is the activity hysteresis for every lot at the time of semi-conductor manufacture, and this is displayed on the display screen of the display terminal 10 for semi-conductor production control. That is, in order to confirm whether any problems have occurred on the check of progress of processing, and wafer processing in the middle of wafer processing, an operator needs to check the activity hysteresis of wafer processing about each lot. Whenever the sheet as which the activity hysteresis of the wafer processing which calls these a run sheet or a lot travelers with the conventional technique was written down in each wafer lot was attached together with the lot and performed wafer processing, the operator had filled in the worksheet. However, in this example, the activity hysteresis of a wafer can be easily checked now by calling the hysteresis of the wafer 15 held in the wafer cassette 13 concerned from the database 2 for semi-conductor production control, and calling to the display screen on the display terminal 10 for semi-conductor production control by reading the bar code 14 attached to the wafer cassette 13 by the bar code reader 17, and recognizing a lot at the display terminal 10 for semi-conductor production control.
[0026] The down-stream-processing flow of the future about processing hysteresis information and these lots, such as the operator ID who a product name, number of sheets, and the present began the display screen of drawing 3 as information on a lot, and performed a process, the past down stream processing, a processor, processing time, processing conditions, and processing, etc. is displayed.
[0027] In addition, it is possible to check information by every place according to construction of the intranet which could install this display terminal 10 for semi-conductor production control in every place not only through near a manufacturing installation 8 but through the communication network in works (LAN3), and used the TCP/IP protocol. Furthermore, if security, such as a fire wall, is established, it will also become possible by accessing LAN3 concerned from the exterior to check information from the whole world through the Internet technique.
[0028] Drawing 5 is the outline of the wafer visual-inspection equipment 20 used for a semi-conductor wafer process. 21 in the said drawing is a wafer inspection stage, and the wafer supported by the wafer delivery arm 28 from the checking wafer cassette 23 is laid. The wafer inspection image camera 31 is arranged above this wafer inspection stage 21, and a photography image can observe under a microscope 22.
[0029] 25 is the wafer migration section and its above-mentioned wafer delivery arm 28 and above-mentioned wafer feeder 26 are movable in this drawing Nakamizu common direction in an orbit top. 24 is a defect wafer receipt cassette and the wafer judged that the result of inspection is poor is contained

by the cassette 24 concerned. 27 is a UEHAPURI alignment stage and it is possible to tune the wafer on the wafer inspection stage 21 finely in the optimal location for inspection by actuation of a joy stick 29. 30 is the inspection result input section and the input key for an operator to input a visual-inspection result is arranged. 32 is a monitor and can display the photography image of said wafer inspection image camera 31. 33 is a network circuit for a host communication link, and inspection data can be transmitted and received to the data server 1 (host) for semi-conductor production control through a terminal server 6.

[0030] Drawing 6 expresses a communication link sequence with the host in the visual inspection at this time. First, if each wafer cassette 23 is set in visual-inspection equipment 20 and Cassette ID is read through the bar code reader 17 of the near display terminal 10 for semi-conductor production control of visual-inspection equipment 20 (601), the ID concerned will be sent to the data server 1 (host) for semi-conductor production control through a communication network 33.

[0031] In the data server 1 (host) for semi-conductor production control, the process check of the lot in the cassette concerned is performed (602), and if this result is right (603), an inspection recipe will be sent to wafer visual-inspection equipment 20 with a lot ID and lot information.

[0032] With visual-inspection equipment 20, if said information is received, while notifying inspection initiation to the data server 1 (host) for semi-conductor production control, an inspection wafer is set to the inspection stage 21 according to an inspection recipe (604). Next, location **** of wear is performed (605) and the inspection result inputted in the inspection result input section 30 and the wafer image photoed with the wafer inspection image camera 31 are captured (606,607). A judgment of good / defect, and a defect category code is made as an inspection result, and, specifically, this is performed by inputting a result from the inspection result input section 30. And this inspection result and a wafer image are sent to the data server 1 (host) for semi-conductor production control. The data concerned are stored in a database 2 in the data server 1 (host) for semi-conductor production control which received these data (608). With wafer visual-inspection equipment 20, the processing succeedingly explained at said steps 604-608 is repeated (609). And inspection termination of a lot is notified from wafer visual-inspection equipment 20, and when the completion command of inspection is inputted by the operator from the display terminal 10 for semi-conductor production control, wafer visual inspection is completed (610).

[0033] Thus, in this example, since acquisition of a wafer image image data is enabled and this wafer image image data is stored [inspection result / which was inputted by the operator] in the database 2 with the data (text data) of a visual-inspection result, inspection information can be grasped visually afterwards.

[0034] That is, only the operator who used visual-inspection equipment could see the wafer appearance at the time of the conventional visual inspection, but signal transduction has been given to other human beings by leaving an operator's comment on inspection processing hysteresis about the phenomenon which calls an operator's attention. However, the inspection information over wafer processing increases by leaps and bounds by enabling it to treat the image image data of an inspection wafer as inspection hysteresis with the processing hysteresis information on inspection, and an operator's comment information like this example.

[0035]

[Example 2] Drawing 7 shows the display screen of the inspection processing hysteresis of a wafer visual-inspection activity. That is, it is this drawing which displayed the image image data of the inspection wafer acquired in the example 1 on the display screen 16 of the display terminal 10 for semi-conductor production control.

[0036] As shown in drawing 7 , in the display screen 16, there are whether the visual-inspection activity's being completed and display area (left-hand side in the display screen) still expressed [whether it has ended and]. Moreover, the display area of a wafer visual-inspection result and a defect category code is rewritable with an operator.

[0037] Drawing 8 shows the sequence in the case of displaying the hysteresis information on a wafer appearance activity. When the operator concerning the back process in works and the engineer of a

sitting-room want to see activity processing hysteresis (step 801), the bar code 14 of the wafer cassette 13 is first read using the bar code reader 17 of the display terminal 10 for semi-conductor production control. The display terminal 10 for semi-conductor production control extracts Cassette ID from the read bar code, and transmits this cassette ID to the data server 1 (host) for semi-conductor production control.

[0038] The cassette ID concerned is used as a search key, and a database 2 is searched with the data server 1 (host) for semi-conductor production control. And the process processing activity hysteresis information on the cassette ID concerned is created from the ****(ed) information (802), and this hysteresis information is transmitted to the display terminal 10 for semi-conductor production control. The process processing activity hysteresis of the lot of the cassette ID concerned which carried out in this way and was received is expressed to the display screen 16 as the display terminal 10 for semi-conductor production control. Text data is still a core and a display here is hysteresis information as shown in drawing 3 .

[0039] On the other hand, when the demand of the detailed information of an inspection process is made from an inspection person in charge, the data server 1 (host) for semi-conductor production control creates the processing hysteresis information and the wafer image image data of a wafer visual-inspection process as a display screen (804), and transmits this screen data to the display terminal 10 for semi-conductor production control. The wafer image image data which this showed to drawing 7 is displayed on the display screen 16 (805).

[0040] Looking at this wafer image image data, an inspection person in charge checks an inspection result (806), and inputs that result. When there is an input as a result, at the display terminal 10 for semi-conductor production control, the completion flags after acquisition of inspection, such as an inspection result and a defect category, are set (808). And updating data are sent to the data server 1 (host) for semi-conductor production control. In the data server 1 (host) for semi-conductor production control, a database 2 is updated based on this updating data (809).

[0041] Thus, in this example, the inspection person in charge who needs the information on inspection processing hysteresis to the timing of arbitration enables a wafer image image and activity hysteresis to check to coincidence at the display terminal 10 for semi-conductor production control coordinated with the data server 1 (host) for semi-conductor production control. Big effectiveness, such as cure speedup about the problem on production-line quality, is expectable after inspection with use to fine tuning of the wafer processing conditions in a process, and information share-ization by two or more person number.

[0042] Furthermore, even if it does not judge a visual-inspection result to the timing by which the wafer cassette 13 was set to the visual-inspection machine, decision of an inspection result or a defect category is attained to another timing.

[0043] When special decision knowledge is required of a prototype etc., since it can separate the actuation operator and inspection person in charge of an inspection machine, this can expect the productivity drive of the whole works, such as time amount saving of the waiting for an engineer etc., and operation of Nighttime.

[0044]

[Example 3] Drawing 9 is the outline of the scanning electron microscope for semi-conductors used for a measuring machine. In this drawing, the scanning electron microscope 40 used as a measuring machine 401 consists of a body 41, a wafer cassette auto-loader 42, and a control unit 43 and a control unit 44. moreover, this actuation electron microscope 40 consists of scan converter 48a, pattern recognition section 48b, and reference pattern preservation section 48c -- automatic location appearance is carried out and it has the unit 48. location **** of the circuit pattern whose length holds the reference pattern beforehand to this circuit pattern where a unit 48 measures the length by carrying out automatic location appearance, performs the comparison with an actual circuit pattern, measures the amount of gaps of that X-Y coordinate, tells a length measurement section body, amends gap, and is measured is performed.

[0045] The image of the actuation electron microscope 40 is sent to the data server 1 (host) for semi-conductor production control through a network circuit while it is photoed with a camera 45 and

displayed on the display screen of a monitor 46.
[0046] Next, a communication link sequence with the host in a length measurement process is shown in drawing 10 . First, the wafer cassette 13 is set to the wafer cassette auto-loader 42 of drawing 9 , Cassette ID is read by the bar code reader 17 of the near display terminal 10 for semi-conductor production control of a measuring machine 401 (1001), and this is sent to the data server 1 (host) for semi-conductor production control. In the data server 1 (host) for semi-conductor production control, the process check of the lot in the cassette which corresponds with reference to a database 2 is performed (1002), and if the result of the check concerned is right (1003), a lot ID, lot information, and a measurement recipe will be sent to a measuring machine 401 through the communication network circuit 47.
[0047] in a measuring machine 401, while notifying measurement initiation to the data server 1 (host) for semi-conductor production control, according to said measurement recipe, the wafer for measurement is set to a measurement stage (1004), and carries out automatic location appearance, a unit 48 performs location **** of a wafer (1005), and measurement data is acquired according to the dimension measurement activity using a scanning electron microscope 40 (1006). Acquisition of this measurement data uses the cursor displayed together with an image in the circuit pattern image of the wafer side acquired by the scanning electron microscope 40, and when an operator measures a pattern dimension, specifically, it is performed.
[0048] At this time, the measurement result and length measurement image which captured the length measurement image with the camera 45 (1007), and were obtained by these are sent to the data server 1 (host) for semi-conductor production control through the communication network circuit 47.
[0049] In the data server 1 (host) for semi-conductor production control, it stores in a database 2 by making into hysteresis information the measurement result and length measurement image which were obtained above (1008). And in a measuring machine 401, length measurement in the location of a degree is performed to a wafer (1009). It is sent to the data server 1 (host) for semi-conductor production control like [this length measurement result] said steps 1004-1008.
[0050] Completion of a length measurement process is performed by inputting a completion command into the display terminal 10 for semi-conductor production control (1010). Thus, at this example, the information acquired at the time of length measurement increases by leaps and bounds by treating the hysteresis information on measurement processing, and the image image information of a circuit pattern to coincidence also in a length measurement process.
[0051] Next, the usage of of the length measurement result and length measurement image which were obtained above is explained. Drawing 11 is the display screen of the activity processing hysteresis of the length measurement process displayed on the display terminal 10 for semi-conductor production control.

[0052] Drawing 12 shows the sequence which displays the once collected measurement processing hysteresis information. About the processing hysteresis of length measurement as well as an example 2, the display screen like drawing 11 can obtain to the timing of arbitration in the location of arbitration with the display terminal 10 for semi-conductor production control in works. This detail is explained using drawing 12 .
[0053] When an operator (inspection person in charge) wants to acquire the process processing activity hysteresis information on a processing lot, the cassette ID concerned is read by the bar code reader 17 of the display terminal 10 for (1201) semi-conductor production control. If this cassette ID is sent to the data server 1 (host) for semi-conductor production control, a database 2 will be searched, process processing activity hysteresis information will be created (1202), and it will be sent to the display terminal 10 for semi-conductor production control as display information (text data). An operator refers to the hysteresis information displayed on the display terminal 10 for semi-conductor production control (1203). The hysteresis information at this time serves as a format shown in drawing 3 . And when the information about a length measurement process with a still more detailed operator is required, by directing detailed information or image information on the display terminal 10 for semi-conductor production control, a length measurement process detailed information demand is sent to the data server

1 (host) for semi-conductor production control. If this demand is received, a database 2 will be searched with the data server 1 (host) for semi-conductor production control, the processing hysteresis information on a dimension measurement process and the length measurement image image information of each wafer are created as the display screen (1204), and this is sent to the display terminal 10 for semi-conductor production control.
[0054] Thus, the information shown in drawing 11 is displayed on the display terminal 10 for semi-conductor production control (1205). An operator (inspection person in charge) checks this length measurement result (1206), and when a dimension input is still more nearly required, he performs a dimension entry of data from the inspection result input section 30 of the display terminal 10 for semi-conductor production control.
[0055] At the display terminal 10 for semi-conductor production control, when this dimension entry of data is performed, the length measurement dimension data concerned are transmitted to the data server 1 (host) for semi-conductor production control (1207 1208). In the data server 1 (host) for semi-conductor production control which received the length measurement dimension data concerned, a database 2 is updated and processing is completed.
[0056] Thus, in this example, effectiveness is expectable in fine tuning of the processing conditions in a back process, speedup, improvement in precision in the Rhine quality evaluation by share-izing of the same information, etc. by the ability of the hysteresis information on measurement processing, and the image image information of a circuit pattern to be treated to coincidence also in a length measurement process.
[0057] Moreover, even if it does not perform dimension measurement to the timing by which the wafer cassette 13 was set to the measuring machine 401, it comes to be able to perform dimension measurement to another timing. Also about dimension measurement, the actuation operator and dimension measurement member of a measuring machine 401 can be separated like an example 2, and the productivity drive of works can be realized.
[0058]
[Example 4] Drawing 13 is the display screen of the image image of a wafer appearance or a length measurement circuit pattern. In this example, the image image of the wafer in a lot unit can be looked through now.
[0059] Moreover, drawing 14 is a communication link sequence in the case of displaying the image image of a wafer appearance or a length measurement circuit pattern on a display terminal, and conducting various kinds of investigations. Hereafter, processing of this example is explained to a detail using drawing 14 .
[0060] When an operator (inspection person in charge) and an engineer want to perform image display of the processing lot for investigation, the bar code 14 of the wafer cassette 13 is scanned using the bar code reader 17 of the display terminal 10 for (1401) semi-conductor production control. The display terminal 10 for semi-conductor production control transmits the cassette ID which carried out in this way and was acquired to the data server 1 (host) for semi-conductor production control.
[0061] In the data server 1 (host) for semi-conductor production control, a database 2 is searched, and from the demanded process flow of a lot, demand image setting display information is generated (1402), and it transmits to the display terminal 10 for semi-conductor production control.
[0062] At the display terminal 10 for semi-conductor production control, said demand image setting display information is displayed (1403). A case [here / an operator wants to set up a demand image] to display serially the image of a certain wafer appearances of a series of according to a process flow (for example, an image display demand is transmitted to the data server 1 (host) for semi-conductor production control through the display terminal 10 for semi-conductor production control.)
[0063] In the data server 1 (host) for semi-conductor production control which received said image display demand, a database 2 is searched, the images about a series of wafers concerned are collected, and the display screen is created (1405 1406). And the created display screen is transmitted and displayed on the display terminal 10 for semi-conductor production control (1407). Consequently, the displayed image shows drawing 13 . In this drawing, since a list indication of the wafer image is given

serially, the analysis of the quality trouble of a semi-conductor product becomes very easy. Moreover, since treating until now can treat the image information of the difficult wafer side or a circuit pattern with wafer processing hysteresis, it becomes the leading information for guaranteeing the quality of a product to a user claim.

[0064]

[Example 5] Drawing 15 is the schematic diagram of the wafer automatic material handling system of wafer process works, and drawing 16 is the explanatory view showing the conveyance condition within a process in the measuring machine in it.

[0065] 50 are a process conveyance way among drawing, 51 is an automatic warehouse (stocker) and 52 is an automatic-warehouse migration station. Moreover, 53 is an automatic-warehouse AGV port and exchanges the wafer cassette 13 between AGV54.

[0066] 55 is a conveyance way in an AGV bay, and a manufacturing installation 56, wafer visual-inspection equipment 57, and a measuring machine 58 are arranged along this conveyance way 55 in a bay at that periphery. as shown in drawing 16 , since it corresponded to full automation, drawing 9 explained the measuring machine 58 -- automatic location appearance is carried out and it has the unit 48. location **** of the circuit pattern whose length holds the reference pattern beforehand to this circuit pattern where a unit 48 measures the length by carrying out automatic location appearance, performs the comparison with an actual circuit pattern, measures the amount of gaps of that X-Y coordinate, tells a length measurement section body, amends gap, and is measured is performed.

[0067] Moreover, the robot arm 62 is formed in AGV54, and the length measurement wafer cassette 61 of a measuring machine 401 can be transferred now to the wafer cassette place 63 side.

[0068] Drawing 17 shows the communication link sequence of the system which produces the length measurement process of wafer process works by uninhabited. First, a measuring machine 401 outputs a demand of lot information to the data server 1 (host) for semi-conductor production control, when it is in the condition that the length can be measured. In response to the demand from a measuring machine 401, a measurable lot is begun in works with the measuring machine 401, and the data server 1 (host) for semi-conductor production control is searched from a lot (1701).

[0069] Here, to the conveyance controller 11 which controls a conveyance system, when there is a lot whose length can be measured (1702), a command is issued so that even a measuring machine 401 may convey and transfer the lot (1703).

[0070] The conveyance controller 11 operates the automatic-warehouse migration station 52 and AGV54 grade so that a measurement lot may be conveyed to the corresponding measuring machine 401 (1704). And further, if a measurement lot is set to a measuring machine 401 by actuation of the robot arm 62 of AGV54 shown in drawing 16 (1705), the completion of conveyance will be notified to the data server 1 (host) for semi-conductor production control by it from a conveyance controller. With it, a lot information inquiry of a measurement lot is performed from a measuring machine 401 to the data server 1 (host) for semi-conductor production control, and the data server 1 (host) for semi-conductor production control notifies lot information and a measurement recipe to a measuring machine 401 to this.

[0071] In a measuring machine 401, according to said recipe, location **** of the circuit pattern of the specific point of a wafer side is performed, and a length measurement image is captured (1706 1707). And this wafer measuring-point information and length measurement image image information are transmitted to the data server 1 (host) for semi-conductor production control. And in order to tell not carrying out dimension measurement to the data server 1 (host) for semi-conductor production control, a migration image incorporation flag is set and it transmits (1708 1709). After incorporation of the length measurement image of a lot is completed, a measuring machine 401 tells a conveyance demand at degree process of the notice of the lot end of measurement, and a lot to the data server 1 (host) for semi-conductor production control, in order to carry forward a lot to degree process.

[0072] The data server 1 (host) for semi-conductor production control receives this notice, searches degree process (1711), and outputs the conveyance directions for conveying a length measurement lot to degree process to the conveyance controller 11. Based on this, the conveyance controller 11 directs the

automatic transfer of a measured lot (1712), and conveys the lot concerned at degree process (1712).
[0073] In this example, as explained above, processing of a length measurement process is completed without operator intervention, and wafer lot will be in the state waiting for processing of the following process. the same actuation as the above is possible by using the test equipment in which automatic location appearance also of the case of an inspection process is carried out, and it has a function on the other hand.
[0074] Drawing 19 is a sequence in the case of carrying out dimension measurement of the length measurement circuit pattern image obtained by doing in this way to another timing. For example, a dimension measurement member gets down to sitting-rooms other than the clean room which performs wafer processing etc., and the case where a host is asked the lot with which the length measurement circuit pattern image is captured at the length measurement process using a display terminal is explained.
[0075] When the operator of a sitting-room wants to perform dimension measurement (1901), the demand concerned is first inputted from the display terminal 10 for semi-conductor production control. When this demand reaches the data server 1 (host) for semi-conductor production control, the data server 1 (host) for semi-conductor production control searches a database 2 (1902), and makes the display terminal 10 for semi-conductor production control transmit and display the corresponding lot information (1903).
[0076] When an operator chooses the lot which performs length measurement from the lot displayed on the display terminal 10 for semi-conductor production control (1904), ID of a measurement lot is inputted to the display terminal 10 for semi-conductor production control. If the ID concerned is received via the display terminal 10 for semi-conductor production control by the data server 1 (host) for semi-conductor production control, the data server 1 (host) for semi-conductor production control will search a database 2, and will extract the activity hysteresis information and the length measurement image of the measurement lot concerned (1905). And the obtained length measurement image is transmitted to the display terminal 10 for semi-conductor production control, and the image concerned is displayed on the display screen of the display terminal 10 for semi-conductor production control (1906).

[0077] An operator performs dimension measurement based on the image displayed on the display terminal 10 for semi-conductor production control (1907), and inputs this measurement dimension value from the display terminal 10 for semi-conductor production control. Thus, the inputted measurement dimension value is transmitted to the data server 1 (host) for semi-conductor production control with the flag of the end of measurement. In the data server 1 (host) for semi-conductor production control, a measurement dimension value is added about the applicable lot of a database 2, and an end-of-measurement flag is changed into a set condition.
[0078] thus, at this example, the length measurement circuit pattern image of the measuring machine 401 which receives and carries out automatic location appearance of the measurement recipe, and has a function and a function corresponding to conveyance within a process is stored as image image information by the data server 1 (host) for semi-conductor production control. Therefore, dimension measurement can be performed to timing other than the usual timing, and the full automation wafer process production of a measuring machine 401 is attained nothing by the operator also in the clean room of the semi-conductor wafer process works arranged by the same location as a manufacturing installation 8.
[0079] Even if visual-inspection equipment 20 is arranged by giving the same function also to visual-inspection equipment 20 by the same location as a manufacturing installation 8, production of a full automation wafer process is realizable similarly.
[0080] By uninhabited wafer process production, wafer processing not only according to maintenance of the air cleanliness class of a wafer side but the detailed production processing schedule which was difficult in human being's activity can be performed, and production TAT compaction and equalization production can be realized until now as planned.
[0081]

[Effect of the Invention] According to this invention, the inspection information over wafer processing can be increased by leaps and bounds by enabling it to treat the image image data of an inspection wafer as inspection hysteresis with the processing hysteresis information on inspection, and an operator's comment information.

[Translation done.]

* NOTICES *

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the information management in a semi-conductor wafer process. At the process works of a semi-conductor wafer, it points to production TAT compaction and equalization production for a productivity drive.
[0002] For the purpose of said productivity drive, construction of the automation production system (CIM) which combined the production process management automatic material handling system by the information management which used the computer system also in the improvement in a semi-conductor wafer process is made in recent years.
[0003] Consequently, about the production process which performs wafer processing of the latest chip fabrication factory, it can be said that it is coming to the phase where wafer processing can be mostly performed by uninhabited.

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EFFECT OF THE INVENTION

[Effect of the Invention] According to this invention, the inspection information over wafer processing can be increased by leaps and bounds by enabling it to treat the image image data of an inspection wafer as inspection hysteresis with the processing hysteresis information on inspection, and an operator's comment information.

[Translation done.]

* NOTICES *

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, it is said that inspection and a measurement process are in the situation that this full automation production is uniquely unrealizable.
[0005] That is, it is also important for the inspection and measurement in a semi-conductor wafer process that an operator's activity has taken the lead and takes human being's production activity and adjustment of the wafer processing cycle in a manufacturing installation for a productivity drive.
[0006] And it is expected that this process continues to become increasingly important with detailed-izing of a wafer process. This invention is made paying attention to such a point, about the inspection and the measurement process in a semi-conductor wafer process, tends to change the gestalt of an activity and tends to raise the productivity as improvement in a wafer process.

[Translation done.]

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MEANS

[Means for Solving the Problem] A photography means by which the 1st means of this invention photos the surface image of a semi-conductor, and a hysteresis input means to input the hysteresis information on semi-conductor processing, The image data area which stores the photography image obtained by the photography means, and the historical-data field which stores as text the semi-conductor processing hysteresis inputted by the hysteresis input means, It consists of the host means and terminal means which were connected with the database equipped with the table which associates these image data areas and historical-data fields through the communication line. Said host means When there is enquiry of hysteresis information from said terminal means, it is the semi-conductor production process managerial system which outputs the processing hysteresis of the semi-conductor which searches said database and corresponds to a terminal means.
[0008] By associating the processing hysteresis information and screen information of a semi-conductor on a table, and managing them, if needed, the validity of inspection can be examined, or a photography process and an inspection process can be divided in time, and an inspection process can be efficiently performed with reference to the display screen of a terminal means in another room.
[0009] The step which outputs the processing hysteresis of the semi-conductor which the 2nd means searches a database when there is enquiry from a terminal means in said host means, and corresponds to a terminal means, An image information demand is received displaying said processing hysteresis on a terminal means. When the image information demand concerned is received, said database is searched, the image data corresponding to said processing hysteresis information is ****(ed), and sequential execution of the step which displays image data on said terminal means with said processing hysteresis information is carried out.
[0010] That is, decline in the processing effectiveness resulting from presenting of unnecessary image information can be prevented by ordering image information from a host means with reference to processing hysteresis if needed only by text on a display terminal.
[0011] The 3rd means includes the flag of whether inspection was completed in the historical data stored in said database. When a photography process and an inspection process are divided in time, the existence of inspection becomes clear with the flag concerned.
[0012] The 4th means enabled rewriting of said flag, referring to the processing hysteresis and the image data which were displayed on said terminal means. That is, after performing inspection of visual inspection etc., referring to processing hysteresis and image data on a display terminal, the direct flag was rewritten from on the display terminal.
[0013] The 5th means connects said host means by the semi-conductor conveyance system control means and the communication line, and it was made to operate a semi-conductor conveyance system according to the demand from said terminal means. Since conveyance of a wafer is controllable by the host means by making it a conveyance system interlocked with, incorporation of an automatic location ****** image is automatable.
[0014] In said 1st means, the semi-conductor production process managerial system is equipped with the circuit pattern dimension measuring device on the front face of a semi-conductor equipped with the

**** electron microscope, and the 6th means stores the measurement result and measurement image which were performed through the **** electron microscope concerned as the historical data in said database, and image data.
[0015] Thus, also in a length measurement process, while the hysteresis information on measurement and the image image information of a circuit pattern can be treated to coincidence and the effectiveness of a length measurement activity improves sharply, length measurement precision can be raised.
[0016]
[Embodiment of the Invention] The operation gestalt of this invention is explained based on drawing.
[0017]
[Example 1] An approximate account Fig. in case the display screen of the lot processing activity hysteresis which drawing 1 uses the outline control schematic diagram of the production automation system in semi-conductor wafer process works and drawing 2 for the process flow Fig. of a semi-conductor wafer process, and uses drawing 3 at the time of semi-conductor manufacture, and drawing 4 perform an activity processing hysteresis display, and drawing 5 are the explanatory views showing wafer visual-inspection equipment.
[0018] In drawing 1 , 1 is a data server for semi-conductor production control, and functions as a host server which manages the whole process. That is, the data server 1 for semi-conductor production control treats the down-stream-processing procedure of each production wafer lot, processing conditions, and the collection data after wafer processing, and keeps information. Moreover, this server 1 has the database 2 which consisted of large capacity storage for said management.
[0019] It is drawing 20 which showed the configuration of said database 2. A database 2 uses a lot ID as a key, and has the index table 2001 with which the storing address of wafer historical data and the storing address of wafer image data were matched.
[0020] The processing hysteresis in a semi-conductor production process as shown in drawing 3 is stored in the wafer historical data 2002 in a database 2 as text data. Moreover, the image data on the front face of a wafer obtained in the below-mentioned visual-inspection equipment 20 grade is stored in the wafer image data 2003. Thus, the wafer historical data 2002 and the wafer image data 2003 are associated and managed by the index table 2001.
[0021] It connects with LAN3 and said data server 1 for semi-conductor production control is connected with the area computer 5 for automation which manages 1 area of a production process through the bridge 4 for communication networks in the key point at LAN3 concerned.
[0022] The display terminal 10 (refer to drawing 4) for semi-conductor production control is connected to the area computer 5 for automation through the repeater 7. Furthermore, various kinds of manufacturing installations 8, and a measurement machine and test equipment 9 are connected through the terminal server 6. Furthermore, the area computer 5 for automation is connected with the conveyance controller 11, and this conveyance controller 11 is connected to LAN for transfer controls.
[0023] In the above-mentioned system configuration, a semi-conductor wafer leads the conveyance system controlled by the conveyance controller 11, and is conveyed and transferred at a manufacturing installation 8. And wafer processing conditions are told to a manufacturing installation 8 through LAN3, a bridge 4, and a terminal server 6 by the data server 1 (host) for semi-conductor production control from the data pace 2, and processing is performed.
[0024] After the lot activity processing hysteresis information and collection data after processing termination are stored in a database 2 by the reverse root, they are used by every place which need data. After wafer processing usually conducts wafer visual inspection, and progresses to the following down stream processing. Drawing 5 shows the configuration of wafer visual-inspection equipment 20. By drawing 1 , this wafer visual-inspection equipment 20 is contained in a measurement machine and test equipment 9, and is connected to the data server 1 (host) for semi-conductor production control through the terminal server 6 grade like said above-mentioned manufacturing installation 8.
[0025] Drawing 3 is the activity hysteresis for every lot at the time of semi-conductor manufacture, and this is displayed on the display screen of the display terminal 10 for semi-conductor production control. That is, in order to confirm whether any problems have occurred on the check of progress of processing,

and wafer processing in the middle of wafer processing, an operator needs to check the activity hysteresis of wafer processing about each lot. Whenever the sheet as which the activity hysteresis of the wafer processing which calls these a run sheet or a lot travelers with the conventional technique was written down in each wafer lot was attached together with the lot and performed wafer processing, the operator had filled in the worksheet. However, in this example, the activity hysteresis of a wafer can be easily checked now by calling the hysteresis of the wafer 15 held in the wafer cassette 13 concerned from the database 2 for semi-conductor production control, and calling to the display screen on the display terminal 10 for semi-conductor production control by reading the bar code 14 attached to the wafer cassette 13 by the bar code reader 17, and recognizing a lot at the display terminal 10 for semi-conductor production control.

[0026] The down-stream-processing flow of the future about processing hysteresis information and these lots, such as the operator ID who a product name, number of sheets, and the present began the display screen of drawing 3 as information on a lot, and performed a process, the past down stream processing, a processor, processing time, processing conditions, and processing, etc. is displayed.

[0027] In addition, it is possible to check information by every place according to construction of the intranet which could install this display terminal 10 for semi-conductor production control in every place not only through near a manufacturing installation 8 but through the communication network in works (LAN3), and used the TCP/IP protocol. Furthermore, if security, such as a fire wall, is established, it will also become possible by accessing LAN3 concerned from the exterior to check information from the whole world through the Internet technique.

[0028] Drawing 5 is the outline of the wafer visual-inspection equipment 20 used for a semi-conductor wafer process. 21 in the said drawing is a wafer inspection stage, and the wafer supported by the wafer delivery arm 28 from the checking wafer cassette 23 is laid. The wafer inspection image camera 31 is arranged above this wafer inspection stage 21, and a photography image can observe under a microscope 22.

[0029] 25 is the wafer migration section and its above-mentioned wafer delivery arm 28 and above-mentioned wafer feeder 26 are movable in this drawing Nakamizu common direction in an orbit top. 24 is a defect wafer receipt cassette and the wafer judged that the result of inspection is poor is contained by the cassette 24 concerned. 27 is a UEHAPURI alignment stage and it is possible to tune the wafer on the wafer inspection stage 21 finely in the optimal location for inspection by actuation of a joy stick 29. 30 is the inspection result input section and the input key for an operator to input a visual-inspection result is arranged. 32 is a monitor and can display the photography image of said wafer inspection image camera 31. 33 is a network circuit for a host communication link, and inspection data can be transmitted and received to the data server 1 (host) for semi-conductor production control through a terminal server 6.

[0030] Drawing 6 expresses a communication link sequence with the host in the visual inspection at this time. First, if each wafer cassette 23 is set in visual-inspection equipment 20 and Cassette ID is read through the bar code reader 17 of the near display terminal 10 for semi-conductor production control of visual-inspection equipment 20 (601), the ID concerned will be sent to the data server 1 (host) for semi-conductor production control through a communication network 33.

[0031] In the data server 1 (host) for semi-conductor production control, the process check of the lot in the cassette concerned is performed (602), and if this result is right (603), an inspection recipe will be sent to wafer visual-inspection equipment 20 with a lot ID and lot information.

[0032] With visual-inspection equipment 20, if said information is received, while notifying inspection initiation to the data server 1 (host) for semi-conductor production control, an inspection wafer is set to the inspection stage 21 according to an inspection recipe (604). Next, location **** of wear is performed (605) and the inspection result inputted in the inspection result input section 30 and the wafer image photoed with the wafer inspection image camera 31 are captured (606,607). A judgment of good / defect, and a defect category code is made as an inspection result, and, specifically, this is performed by inputting a result from the inspection result input section 30. And this inspection result and a wafer image are sent to the data server 1 (host) for semi-conductor production control. The data concerned are

stored in a database 2 in the data server 1 (host) for semi-conductor production control which received these data (608). With wafer visual-inspection equipment 20, the processing succeedingly explained at said steps 604-608 is repeated (609). And inspection termination of a lot is notified from wafer visual-inspection equipment 20, and when the completion command of inspection is inputted by the operator from the display terminal 10 for semi-conductor production control, wafer visual inspection is completed (610).

[0033] Thus, in this example, since acquisition of a wafer image image data is enabled and this wafer image image data is stored [inspection result / which was inputted by the operator] in the database 2 with the data (text data) of a visual-inspection result, inspection information can be grasped visually afterwards.

[0034] That is, only the operator who used visual-inspection equipment could see the wafer appearance at the time of the conventional visual inspection, but signal transduction has been given to other human beings by leaving an operator's comment on inspection processing hysteresis about the phenomenon which calls an operator's attention. However, the inspection information over wafer processing increases by leaps and bounds by enabling it to treat the image image data of an inspection wafer as inspection hysteresis with the processing hysteresis information on inspection, and an operator's comment information like this example.

[0035]

[Example 2] Drawing 7 shows the display screen of the inspection processing hysteresis of a wafer visual-inspection activity. That is, it is this drawing which displayed the image image data of the inspection wafer acquired in the example 1 on the display screen 16 of the display terminal 10 for semi-conductor production control.

[0036] As shown in drawing 7 , in the display screen 16, there are whether the visual-inspection activity's being completed and display area (left-hand side in the display screen) still expressed [whether it has ended and]. Moreover, the display area of a wafer visual-inspection result and a defect category code is rewritable with an operator.

[0037] Drawing 8 shows the sequence in the case of displaying the hysteresis information on a wafer appearance activity. When the operator concerning the back process in works and the engineer of a sitting-room want to see activity processing hysteresis (step 801), the bar code 14 of the wafer cassette 13 is first read using the bar code reader 17 of the display terminal 10 for semi-conductor production control. The display terminal 10 for semi-conductor production control extracts Cassette ID from the read bar code, and transmits this cassette ID to the data server 1 (host) for semi-conductor production control.

[0038] The cassette ID concerned is used as a search key, and a database 2 is searched with the data server 1 (host) for semi-conductor production control. And the process processing activity hysteresis information on the cassette ID concerned is created from the ****(ed) information (802), and this hysteresis information is transmitted to the display terminal 10 for semi-conductor production control. The process processing activity hysteresis of the lot of the cassette ID concerned which carried out in this way and was received is expressed to the display screen 16 as the display terminal 10 for semi-conductor production control. Text data is still a core and a display here is hysteresis information as shown in drawing 3 .

[0039] On the other hand, when the demand of the detailed information of an inspection process is made from an inspection person in charge, the data server 1 (host) for semi-conductor production control creates the processing hysteresis information and the wafer image image data of a wafer visual-inspection process as a display screen (804), and transmits this screen data to the display terminal 10 for semi-conductor production control. The wafer image image data which this showed to drawing 7 is displayed on the display screen 16 (805).

[0040] Looking at this wafer image image data, an inspection person in charge checks an inspection result (806), and inputs that result. When there is an input as a result, at the display terminal 10 for semi-conductor production control, the completion flags after acquisition of inspection, such as an inspection result and a defect category, are set (808). And updating data are sent to the data server 1 (host) for

semi-conductor production control. In the data server 1 (host) for semi-conductor production control, a database 2 is updated based on this updating data (809).
[0041] Thus, in this example, the inspection person in charge who needs the information on inspection processing hysteresis to the timing of arbitration enables a wafer image image and activity hysteresis to check to coincidence at the display terminal 10 for semi-conductor production control coordinated with the data server 1 (host) for semi-conductor production control. Big effectiveness, such as cure speedup about the problem on production-line quality, is expectable after inspection with use to fine tuning of the wafer processing conditions in a process, and information share-ization by two or more person number.
[0042] Furthermore, even if it does not judge a visual-inspection result to the timing by which the wafer cassette 13 was set to the visual-inspection machine, decision of an inspection result or a defect category is attained to another timing.
[0043] When special decision knowledge is required of a prototype etc., since it can separate the actuation operator and inspection person in charge of an inspection machine, this can expect the productivity drive of the whole works, such as time amount saving of the waiting for an engineer etc., and operation of Nighttime.
[0044]
[Example 3] Drawing 9 is the outline of the scanning electron microscope for semi-conductors used for a measuring machine. In this drawing, the scanning electron microscope 40 used as a measuring machine 401 consists of a body 41, a wafer cassette auto-loader 42, and a control unit 43 and a control unit 44. moreover, this actuation electron microscope 40 consists of scan converter 48a, pattern recognition section 48b, and reference pattern preservation section 48c -- automatic location appearance is carried out and it has the unit 48. location **** of the circuit pattern whose length holds the reference pattern beforehand to this circuit pattern where a unit 48 measures the length by carrying out automatic location appearance, performs the comparison with an actual circuit pattern, measures the amount of gaps of that X-Y coordinate, tells a length measurement section body, amends gap, and is measured is performed.
[0045] The image of the actuation electron microscope 40 is sent to the data server 1 (host) for semi-conductor production control through a network circuit while it is photoed with a camera 45 and displayed on the display screen of a monitor 46.
[0046] Next, a communication link sequence with the host in a length measurement process is shown in drawing 10 . First, the wafer cassette 13 is set to the wafer cassette auto-loader 42 of drawing 9 , Cassette ID is read by the bar code reader 17 of the near display terminal 10 for semi-conductor production control of a measuring machine 401 (1001), and this is sent to the data server 1 (host) for semi-conductor production control. In the data server 1 (host) for semi-conductor production control, the process check of the lot in the cassette which corresponds with reference to a database 2 is performed (1002), and if the result of the check concerned is right (1003), a lot ID, lot information, and a measurement recipe will be sent to a measuring machine 401 through the communication network circuit 47.
[0047] in a measuring machine 401, while notifying measurement initiation to the data server 1 (host) for semi-conductor production control, according to said measurement recipe, the wafer for measurement is set to a measurement stage (1004), and carries out automatic location appearance, a unit 48 performs location **** of a wafer (1005), and measurement data is acquired according to the dimension measurement activity using a scanning electron microscope 40 (1006). Acquisition of this measurement data uses the cursor displayed together with an image in the circuit pattern image of the wafer side acquired by the scanning electron microscope 40, and when an operator measures a pattern dimension, specifically, it is performed.
[0048] At this time, the measurement result and length measurement image which captured the length measurement image with the camera 45 (1007), and were obtained by these are sent to the data server 1 (host) for semi-conductor production control through the communication network circuit 47.
[0049] In the data server 1 (host) for semi-conductor production control, it stores in a database 2 by making into hysteresis information the measurement result and length measurement image which were

obtained above (1008). And in a measuring machine 401, length measurement in the location of a degree is performed to a wafer (1009). It is sent to the data server 1 (host) for semi-conductor production control like [this length measurement result] said steps 1004-1008.
[0050] Completion of a length measurement process is performed by inputting a completion command into the display terminal 10 for semi-conductor production control (1010). Thus, at this example, the information acquired at the time of length measurement increases by leaps and bounds by treating the hysteresis information on measurement processing, and the image image information of a circuit pattern to coincidence also in a length measurement process.
[0051] Next, the usage of of the length measurement result and length measurement image which were obtained above is explained. Drawing 11 is the display screen of the activity processing hysteresis of the length measurement process displayed on the display terminal 10 for semi-conductor production control.

[0052] Drawing 12 shows the sequence which displays the once collected measurement processing hysteresis information. About the processing hysteresis of length measurement as well as an example 2, the display screen like drawing 11 can obtain to the timing of arbitration in the location of arbitration with the display terminal 10 for semi-conductor production control in works. This detail is explained using drawing 12 .
[0053] When an operator (inspection person in charge) wants to acquire the process processing activity hysteresis information on a processing lot, the cassette ID concerned is read by the bar code reader 17 of the display terminal 10 for (1201) semi-conductor production control. If this cassette ID is sent to the data server 1 (host) for semi-conductor production control, a database 2 will be searched, process processing activity hysteresis information will be created (1202), and it will be sent to the display terminal 10 for semi-conductor production control as display information (text data). An operator refers to the hysteresis information displayed on the display terminal 10 for semi-conductor production control (1203). The hysteresis information at this time serves as a format shown in drawing 3 . And when the information about a length measurement process with a still more detailed operator is required, by directing detailed information or image information on the display terminal 10 for semi-conductor production control, a length measurement process detailed information demand is sent to the data server 1 (host) for semi-conductor production control. If this demand is received, a database 2 will be searched with the data server 1 (host) for semi-conductor production control, the processing hysteresis information on a dimension measurement process and the length measurement image image information of each wafer are created as the display screen (1204), and this is sent to the display terminal 10 for semi-conductor production control.
[0054] Thus, the information shown in drawing 11 is displayed on the display terminal 10 for semi-conductor production control (1205). An operator (inspection person in charge) checks this length measurement result (1206), and when a dimension input is still more nearly required, he performs a dimension entry of data from the inspection result input section 30 of the display terminal 10 for semi-conductor production control.
[0055] At the display terminal 10 for semi-conductor production control, when this dimension entry of data is performed, the length measurement dimension data concerned are transmitted to the data server 1 (host) for semi-conductor production control (1207 1208). In the data server 1 (host) for semi-conductor production control which received the length measurement dimension data concerned, a database 2 is updated and processing is completed.
[0056] Thus, in this example, effectiveness is expectable in fine tuning of the processing conditions in a back process, speedup, improvement in precision in the Rhine quality evaluation by share-izing of the same information, etc. by the ability of the hysteresis information on measurement processing, and the image image information of a circuit pattern to be treated to coincidence also in a length measurement process.
[0057] Moreover, even if it does not perform dimension measurement to the timing by which the wafer cassette 13 was set to the measuring machine 401, it comes to be able to perform dimension measurement to another timing. Also about dimension measurement, the actuation operator and

dimension measurement member of a measuring machine 401 can be separated like an example 2, and the productivity drive of works can be realized.
[0058]
[Example 4] Drawing 13 is the display screen of the image image of a wafer appearance or a length measurement circuit pattern. In this example, the image image of the wafer in a lot unit can be looked through now.
[0059] Moreover, drawing 14 is a communication link sequence in the case of displaying the image image of a wafer appearance or a length measurement circuit pattern on a display terminal, and conducting various kinds of investigations. Hereafter, processing of this example is explained to a detail using drawing 14 .
[0060] When an operator (inspection person in charge) and an engineer want to perform image display of the processing lot for investigation, the bar code 14 of the wafer cassette 13 is scanned using the bar code reader 17 of the display terminal 10 for (1401) semi-conductor production control. The display terminal 10 for semi-conductor production control transmits the cassette ID which carried out in this way and was acquired to the data server 1 (host) for semi-conductor production control.
[0061] In the data server 1 (host) for semi-conductor production control, a database 2 is searched, and from the demanded process flow of a lot, demand image setting display information is generated (1402), and it transmits to the display terminal 10 for semi-conductor production control.
[0062] At the display terminal 10 for semi-conductor production control, said demand image setting display information is displayed (1403). A case [here / an operator wants to set up a demand image] to display serially the image of a certain wafer appearances of a series of according to a process flow (for example, an image display demand is transmitted to the data server 1 (host) for semi-conductor production control through the display terminal 10 for semi-conductor production control.)
[0063] In the data server 1 (host) for semi-conductor production control which received said image display demand, a database 2 is searched, the images about a series of wafers concerned are collected, and the display screen is created (1405 1406). And the created display screen is transmitted and displayed on the display terminal 10 for semi-conductor production control (1407). Consequently, the displayed image shows drawing 13 . In this drawing, since a list indication of the wafer image is given serially, the analysis of the quality trouble of a semi-conductor product becomes very easy. Moreover, since treating until now can treat the image information of the difficult wafer side or a circuit pattern with wafer processing hysteresis, it becomes the leading information for guaranteeing the quality of a product to a user claim.
[0064]
[Example 5] Drawing 15 is the schematic diagram of the wafer automatic material handling system of wafer process works, and drawing 16 is the explanatory view showing the conveyance condition within a process in the measuring machine in it.
[0065] 50 are a process conveyance way among drawing, 51 is an automatic warehouse (stocker) and 52 is an automatic-warehouse migration station. Moreover, 53 is an automatic-warehouse AGV port and exchanges the wafer cassette 13 between AGV54.
[0066] 55 is a conveyance way in an AGV bay, and a manufacturing installation 56, wafer visual-inspection equipment 57, and a measuring machine 58 are arranged along this conveyance way 55 in a bay at that periphery. as shown in drawing 16 , since it corresponded to full automation, drawing 9 explained the measuring machine 58 -- automatic location appearance is carried out and it has the unit 48. location **** of the circuit pattern whose length holds the reference pattern beforehand to this circuit pattern where a unit 48 measures the length by carrying out automatic location appearance, performs the comparison with an actual circuit pattern, measures the amount of gaps of that X-Y coordinate, tells a length measurement section body, amends gap, and is measured is performed.
[0067] Moreover, the robot arm 62 is formed in AGV54, and the length measurement wafer cassette 61 of a measuring machine 401 can be transferred now to the wafer cassette place 63 side.
[0068] Drawing 17 shows the communication link sequence of the system which produces the length measurement process of wafer process works by uninhabited. First, a measuring machine 401 outputs a

demand of lot information to the data server 1 (host) for semi-conductor production control, when it is in the condition that the length can be measured. In response to the demand from a measuring machine 401, a measurable lot is begun in works with the measuring machine 401, and the data server 1 (host) for semi-conductor production control is searched from a lot (1701).
[0069] Here, to the conveyance controller 11 which controls a conveyance system, when there is a lot whose length can be measured (1702), a command is issued so that even a measuring machine 401 may convey and transfer the lot (1703).
[0070] The conveyance controller 11 operates the automatic-warehouse migration station 52 and AGV54 grade so that a measurement lot may be conveyed to the corresponding measuring machine 401 (1704). And further, if a measurement lot is set to a measuring machine 401 by actuation of the robot arm 62 of AGV54 shown in drawing 16 (1705), the completion of conveyance will be notified to the data server 1 (host) for semi-conductor production control by it from a conveyance controller. With it, a lot information inquiry of a measurement lot is performed from a measuring machine 401 to the data server 1 (host) for semi-conductor production control, and the data server 1 (host) for semi-conductor production control notifies lot information and a measurement recipe to a measuring machine 401 to this.
[0071] In a measuring machine 401, according to said recipe, location **** of the circuit pattern of the specific point of a wafer side is performed, and a length measurement image is captured (1706 1707). And this wafer measuring-point information and length measurement image image information are transmitted to the data server 1 (host) for semi-conductor production control. And in order to tell not carrying out dimension measurement to the data server 1 (host) for semi-conductor production control, a migration image incorporation flag is set and it transmits (1708 1709). After incorporation of the length measurement image of a lot is completed, a measuring machine 401 tells a conveyance demand at degree process of the notice of the lot end of measurement, and a lot to the data server 1 (host) for semi-conductor production control, in order to carry forward a lot to degree process.
[0072] The data server 1 (host) for semi-conductor production control receives this notice, searches degree process (1711), and outputs the conveyance directions for conveying a length measurement lot to degree process to the conveyance controller 11. Based on this, the conveyance controller 11 directs the automatic transfer of a measured lot (1712), and conveys the lot concerned at degree process (1712).
[0073] In this example, as explained above, processing of a length measurement process is completed without operator intervention, and wafer lot will be in the state waiting for processing of the following process. the same actuation as the above is possible by using the test equipment in which automatic location appearance also of the case of an inspection process is carried out, and it has a function on the other hand.
[0074] Drawing 19 is a sequence in the case of carrying out dimension measurement of the length measurement circuit pattern image obtained by doing in this way to another timing. For example, a dimension measurement member gets down to sitting-rooms other than the clean room which performs wafer processing etc., and the case where a host is asked the lot with which the length measurement circuit pattern image is captured at the length measurement process using a display terminal is explained.
[0075] When the operator of a sitting-room wants to perform dimension measurement (1901), the demand concerned is first inputted from the display terminal 10 for semi-conductor production control. When this demand reaches the data server 1 (host) for semi-conductor production control, the data server 1 (host) for semi-conductor production control searches a database 2 (1902), and makes the display terminal 10 for semi-conductor production control transmit and display the corresponding lot information (1903).
[0076] When an operator chooses the lot which performs length measurement from the lot displayed on the display terminal 10 for semi-conductor production control (1904), ID of a measurement lot is inputted to the display terminal 10 for semi-conductor production control. If the ID concerned is received via the display terminal 10 for semi-conductor production control by the data server 1 (host) for semi-conductor production control, the data server 1 (host) for semi-conductor production control will

search a database 2, and will extract the activity hysteresis information and the length measurement image of the measurement lot concerned (1905). And the obtained length measurement image is transmitted to the display terminal 10 for semi-conductor production control, and the image concerned is displayed on the display screen of the display terminal 10 for semi-conductor production control (1906).

[0077] An operator performs dimension measurement based on the image displayed on the display terminal 10 for semi-conductor production control (1907), and inputs this measurement dimension value from the display terminal 10 for semi-conductor production control. Thus, the inputted measurement dimension value is transmitted to the data server 1 (host) for semi-conductor production control with the flag of the end of measurement. In the data server 1 (host) for semi-conductor production control, a measurement dimension value is added about the applicable lot of a database 2, and an end-of-measurement flag is changed into a set condition.
[0078] thus, at this example, the length measurement circuit pattern image of the measuring machine 401 which receives and carries out automatic location appearance of the measurement recipe, and has a function and a function corresponding to conveyance within a process is stored as image image information by the data server 1 (host) for semi-conductor production control. Therefore, dimension measurement can be performed to timing other than the usual timing, and the full automation wafer process production of a measuring machine 401 is attained nothing by the operator also in the clean room of the semi-conductor wafer process works arranged by the same location as a manufacturing installation 8.
[0079] Even if visual-inspection equipment 20 is arranged by giving the same function also to visual-inspection equipment 20 by the same location as a manufacturing installation 8, production of a full automation wafer process is realizable similarly.
[0080] By uninhabited wafer process production, wafer processing not only according to maintenance of the air cleanliness class of a wafer side but the detailed production processing schedule which was difficult in human being's activity can be performed, and production TAT compaction and equalization production can be realized until now as planned.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The outline control schematic diagram of the production automation system in semi-conductor wafer process works
[Drawing 2] The process flow Fig. of a semi-conductor wafer process
[Drawing 3] The display screen of the lot processing activity hysteresis used at the time of semi-conductor manufacture
[Drawing 4] The approximate account Fig. in the case of performing an activity processing hysteresis display on the display terminal for semi-conductor production control
[Drawing 5] The explanatory view showing wafer visual-inspection equipment
[Drawing 6] The sequence diagram having shown the communication procedure with the data server for semi-conductor production control in visual inspection
[Drawing 7] The display screen of the inspection processing hysteresis of a wafer visual-inspection activity
[Drawing 8] The sequence diagram in the case of displaying the hysteresis information on a wafer appearance activity
[Drawing 9] The schematic diagram of the scanning electron microscope for semi-conductors used for a measuring machine
[Drawing 10] The communication link sequence diagram in a length measurement process
[Drawing 11] The display screen Fig. of the activity processing hysteresis in a length measurement process
[Drawing 12] The display sequence diagram of the activity processing hysteresis in a length measurement process
[Drawing 13] The display screen Fig. of wafer visual-inspection equipment and a length measurement image
[Drawing 14] The sequence diagram at the time of wafer visual inspection and length measurement screen investigation
[Drawing 15] The explanatory view showing a wafer automatic material handling system
[Drawing 16] The partial diagrammatic view of the wafer automatic material handling system of the measuring machine neighborhood
[Drawing 17] The communication link sequence diagram of the length measurement process in the system from non-life of a semi-conductor wafer (1)
[Drawing 18] The communication link sequence diagram of the length measurement process in the system from non-life of a semi-conductor wafer (2)
[Drawing 19] The dimension measurement sequence diagram in the system from non-life of a semi-conductor wafer
[Drawing 20] The block diagram showing the internal configuration of a database
[Description of Notations]
1 Data Server for Semi-conductor Production Control (Host)

2 Database
3 LAN
4 Bridge for Communication Networks
5 Area Computer for Automation
6 Terminal Server
7 Repeater
8 Manufacturing Installation
9 Measurement Machine and Test Equipment
10 Display Terminal for Semi-conductor Production Control
11 Conveyance Controller
12 LAN for Transfer Controls
13 Wafer Cassette
14 Bar Code
15 Wafer
16 Display Screen
17 Bar Code Reader
20 Wafer Visual-Inspection Equipment
21 Wafer Inspection Stage
22 Microscope
23 Checking Wafer Cassette
24 Defect Wafer Receipt Cassette
25 Wafer Migration Section
26 Wafer Feeder
27 UEHAPURI Alignment Stage
28 Wafer Delivery Arm
29 Wafer Checking Joy Stick
30 Inspection Result Input Section
31 Wafer Inspection Image Camera
32 Monitor
33 Network Circuit for Host Communication Link
40 Scanning Electron Microscope
41 Body
42 Wafer Cassette Auto-loader
43 Control Unit
44 Control Unit
45 Camera
46 Monitor
47 Network Circuit for Host Communication Link
48 Automatic Location Appearance -- Carrying Out -- Unit
48a Scan converter
48b Pattern recognition equipment
48c Reference pattern preservation section

[Translation done.]

* NOTICES *

CORRECTION OR AMENDMENT

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[Procedure revision]
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[Procedure amendment 1]
[Document to be Amended] Specification
[Item(s) to be Amended] Claim
[Method of Amendment] Modification
[Proposed Amendment]
[Claim(s)]
[Claim 1] A photography means to photo the surface image of a semi-conductor,
A hysteresis input means to input the hysteresis information on semi-conductor processing,
The database equipped with the table which associates the image data area which stores the photography image obtained by the photography means, the historical-data fields which store as text the semi-conductor processing hysteresis inputted by the hysteresis input means, and these image data areas and historical-data fields,
It consists of the host means and terminal means which were connected through the communication line,

Said host means is a semi-conductor production process managerial system which outputs the processing hysteresis of the semi-conductor which searches said database and corresponds when there is enquiry of hysteresis information from said terminal means to a terminal means.

[Claim 2] Said host means is a step which outputs the processing hysteresis of the semi-conductor which searches a database and corresponds to a terminal means when there is enquiry from said terminal means,
The semi-conductor production process managerial system according to claim 1 which carries out sequential execution of the step which said database is searched [step] and the image data corresponding to said processing hysteresis information is ****(ed) [step] when an image information demand is received and the image information demand concerned is received, displaying said processing hysteresis on a terminal means, and displays image data on said terminal means with said processing hysteresis information.
[Claim 3] The semi-conductor production process managerial system according to claim 1 or 2 characterized by containing the flag of whether inspection was completed in the historical data stored in said database.
[Claim 4] Said flag is a semi-conductor production process managerial system according to claim 3 characterized by the ability to rewrite with reference to the processing hysteresis and the image data which were displayed on said terminal means.
[Claim 5] Said host means is a semi-conductor production process managerial system according to claim 1 characterized by operating a semi-conductor conveyance system according to the demand on the communication link from semiconductor fabrication machines and equipment equipped with a photography means to be connected by the semi-conductor conveyance system control means and the communication line, and to photo the surface image of said semi-conductor, and the circuit pattern measurement means by the image.
[Claim 6] Said semi-conductor production process managerial system is equipped with the circuit pattern dimension measuring device on the front face of a semi-conductor equipped with the scanning electron microscope,
The semi-conductor production process managerial system according to claim 1 characterized by storing the measurement result and measurement image which were performed through the scanning electron microscope circuit pattern measuring device concerned as the historical data in said database, and image data.
[Procedure amendment 2]
[Document to be Amended] Specification
[Item(s) to be Amended] 0002
[Method of Amendment] Modification
[Proposed Amendment]
[0002] For the purpose of said productivity drive, construction of the automation production system (CIM) which combined the production process management and the automatic material handling system by the information management which used the computer system also at semi-conductor wafer process works is made in recent years.
[Procedure amendment 3]
[Document to be Amended] Specification
[Item(s) to be Amended] 0006
[Method of Amendment] Modification
[Proposed Amendment]
[0006] And it is expected that this process continues to become increasingly important with detailed-izing of a wafer process. This invention is made paying attention to such a point, about the inspection and the measurement process in a semi-conductor wafer process, tends to change the gestalt of an activity and tends to raise the productivity as wafer process works.
[Procedure amendment 4]
[Document to be Amended] Specification
[Item(s) to be Amended] 0013
[Method of Amendment] Modification
[Proposed Amendment]

[0013] The 5th means connects said host means by the semi-conductor conveyance system control means and the communication line, and it was made to operate a semi-conductor conveyance system according to the demand on the communication link from semiconductor fabrication machines and equipment equipped with a photography means to photo the surface image of said semi-conductor, and the circuit pattern measurement means by the image. Since conveyance of a wafer is controllable by the host means by making it a conveyance system interlocked with, incorporation of an automatic location ****** image is automatable.
[Procedure amendment 5]
[Document to be Amended] Specification
[Item(s) to be Amended] 0014
[Method of Amendment] Modification
[Proposed Amendment]
[0014] In said 1st means, the semi-conductor production process managerial system is equipped with the circuit pattern dimension measuring device on the front face of a semi-conductor equipped with the scanning electron microscope, and the 6th means stores the measurement result and measurement image which were performed through the scanning electron microscope circuit pattern measuring device concerned as the historical data in said database, and image data.
[Procedure amendment 6]
[Document to be Amended] Specification
[Item(s) to be Amended] 0023
[Method of Amendment] Modification
[Proposed Amendment]
[0023] In the above-mentioned system configuration, a semi-conductor wafer leads the conveyance system controlled by the conveyance controller 11, and is conveyed and transferred at a manufacturing installation 8. And wafer processing conditions are told to a manufacturing installation 8 through LAN3, a bridge 4, and a terminal server 6 by the data server 1 (host) for semi-conductor production control from a database 2, and processing is performed.
[Procedure amendment 7]
[Document to be Amended] Specification
[Item(s) to be Amended] 0037
[Method of Amendment] Modification
[Proposed Amendment]
[0037] Drawing 8 shows the sequence in the case of displaying the hysteresis information on a wafer appearance activity. When the operator concerning the back process in works and the engineer who has managed the process want to see activity processing hysteresis (step 801), the bar code 14 of the wafer cassette 13 is first read using the bar code reader 17 of the display terminal 10 for semi-conductor production control. The display terminal 10 for semi-conductor production control extracts Cassette ID from the read bar code, and transmits this cassette ID to the data server 1 (host) for semi-conductor production control.
[Procedure amendment 8]
[Document to be Amended] Specification
[Item(s) to be Amended] 0039
[Method of Amendment] Modification
[Proposed Amendment]
[0039] On the other hand, when the demand of the detailed information of an inspection process is made from an operator, an engineer, or other inspection persons in charge, the data server 1 (host) for semi-conductor production control creates the processing hysteresis information and the wafer image image data of a wafer visual-inspection process as a display screen (804), and transmits this screen data to the display terminal 10 for semi-conductor production control. The wafer image image data which this showed to drawing 7 is displayed on the display screen 16 (805).
[Procedure amendment 9]

[Document to be Amended] Specification
[Item(s) to be Amended] 0040
[Method of Amendment] Modification
[Proposed Amendment]
[0040] If it is an inspection person in charge, looking at this wafer image image data, an inspection result will be checked (806) and that result will be inputted. When there is an input as a result, at the display terminal 10 for semi-conductor production control, the completion flags after acquisition of inspection, such as an inspection result and a defect category, are set (808). And updating data are sent to the data server 1 (host) for semi-conductor production control. In the data server 1 (host) for semi-conductor production control, a database 2 is updated based on this updating data (809).
[Procedure amendment 10]
[Document to be Amended] Specification
[Item(s) to be Amended] 0041
[Method of Amendment] Modification
[Proposed Amendment]
[0041] thus, in this example The operator, the engineer, or other inspection persons in charge who need the information on inspection processing hysteresis to the timing of arbitration enable a wafer image image and activity hysteresis to check to coincidence at the display terminal 10 for semi-conductor production control coordinated with the data server 1 (host) for semi-conductor production control. Big effectiveness, such as cure speedup about the problem on production-line quality, is expectable after inspection with use to fine tuning of the wafer processing conditions in a process, and information share-ization by two or more person number.
[Procedure amendment 11]
[Document to be Amended] Specification
[Item(s) to be Amended] 0044
[Method of Amendment] Modification
[Proposed Amendment]
[0044]
[Example 3] Drawing 9 is the outline of the scanning electron microscope for semi-conductors used for a measuring machine. In this drawing, the scanning electron microscope 40 used as a measuring machine 401 consists of a body 41, a wafer cassette auto-loader 42, and a control unit 43 and a control unit 44. moreover, this scanning electron microscope 40 consists of scan converter 48a, pattern recognition section 48b, and reference pattern preservation section 48c -- automatic location appearance is carried out and it has the unit 48. location **** of the circuit pattern whose length holds the reference pattern beforehand to this circuit pattern where a unit 48 measures the length by carrying out automatic location appearance, performs the comparison with an actual circuit pattern, measures the amount of gaps of that X-Y coordinate, tells a length measurement section body, amends gap, and is measured is performed.
[Procedure amendment 12]
[Document to be Amended] Specification
[Item(s) to be Amended] 0045
[Method of Amendment] Modification
[Proposed Amendment]
[0045] The image of a scanning electron microscope 40 is sent to the data server 1 (host) for semi-conductor production control through a network circuit while it is photoed with a camera 45 and displayed on the display screen of a monitor 46.
[Procedure amendment 13]
[Document to be Amended] Specification
[Item(s) to be Amended] 0071
[Method of Amendment] Modification
[Proposed Amendment]

[0071] In a measuring machine 401, according to said recipe, location **** of the circuit pattern of the specific point of a wafer side is performed, and a length measurement image is captured (1706 1707). And this wafer measuring-point information and length measurement image image information are transmitted to the data server 1 (host) for semi-conductor production control. And in order to tell not carrying out dimension measurement to the data server 1 (host) for semi-conductor production control, an automatic image incorporation flag is set and it transmits (1708 1709). After incorporation of the length measurement image of a lot is completed, a measuring machine 401 tells a conveyance demand at degree process of the notice of the lot end of measurement, and a lot to the data server 1 (host) for semi-conductor production control, in order to carry forward a lot to degree process.

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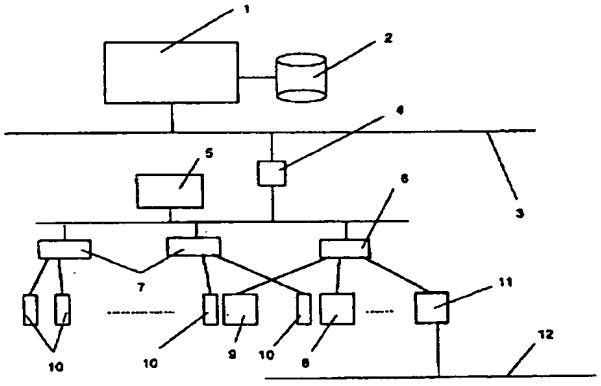
EE59 FF03 FF04 GG04 GC07

(54)【発明の名称】　半導体製造工程管理システム

(57)【要約】
【課題】　半導体製造工程の処理履歴と画像情報とを統合的に管理する。
【解決手段】　データベースに半導体の表面画像と履歴情報とを格納し、これらをテーブルで関連付ける。そして、端末手段からの要求に応じて履歴情報と画像情報とを表示画面に提供する。これにより、半導体表面の撮影と、検査とを時間を隔てても行うことができるようになり、検査効率ひいては半導体の製造効率を大幅に向上させることができる。



【特許請求の範囲】
【請求項１】　半導体の表面画像を撮影する撮影手段と、
半導体処理の履歴情報を入力する履歴入力手段と、
撮影手段により得られた撮影画像を格納する画像データ領域と、履歴入力手段により入力された半導体処理履歴を文字情報として格納する履歴データ領域と、これらの画像データ領域と履歴データ領域とを関連付けるテーブルとを備えたデータベースと、
通信回線を介して接続されたホスト手段と端末手段とからなり、
前記ホスト手段は、前記端末手段から履歴情報の照会があったときに前記データベースを検索して該当する半導体の処理履歴を端末手段に出力する半導体製造工程管理システム。
【請求項２】　前記ホスト手段は、前記端末手段から照会があったときにデータベースを検索して該当する半導体の処理履歴を端末手段に出力するステップと、
前記処理履歴を端末手段上に表示しながら画像情報要求を受け付け、当該画像情報要求を受信したときには前記データベースを検索して前記処理履歴情報に対応した画像データを索出し、前記処理履歴情報とともに画像データを前記端末手段上に表示させるステップを順次実行する請求項１記載の半導体製造工程管理システム。
【請求項３】　前記データベースに格納された履歴データには、検査が完了したか否かのフラグが含まれることを特徴とする請求項１または２記載の半導体製造工程管理システム。
【請求項４】　前記フラグは、前記端末手段に表示された処理履歴および画像データを参照して書き換え可能であることを特徴とする請求項３記載の半導体製造工程管理システム。
【請求項５】　前記ホスト手段は、半導体搬送系制御手段と通信回線で接続されており、前記端末手段からの要求に応じて半導体搬送系を作動させることを特徴とする請求項１記載の半導体製造工程管理システム。
【請求項６】　前記半導体製造工程管理システムは、操査電子顕微鏡を備えた半導体表面の回路パターン寸法測定装置を備え、
当該操査電子顕微鏡を通じて実行された測定結果と測定画像とが前記データベースにおける履歴データと画像データとして格納されることを特徴とする請求項１記載の半導体製造工程管理システム。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は半導体ウエハプロセスにおける情報管理に関するものである。半導体ウエハのプロセス工場では、生産性向上のために生産ＴＡＴ短縮および平準化生産を指向している。
【０００２】前記生産性向上を目的に、近年は半導体ウエハプロセス向上においてもコンピュータシステムを利用した情報管理による生産工程管理自動搬送システムを組み合わせた自動化生産システム（ＣＩＭ）の構築がなされている。
【０００３】その結果、最近の半導体工場のウエハ処理を行う製造工程についてはウエハ処理をほぼ無人で行える段階まできているといえる。
【０００４】
【発明が解決しようとする課題】ところが、唯一この無人化生産を実現できない状況にあるのが検査および測定工程であるといわれている。
【０００５】すなわち、半導体ウエハプロセスにおける検査や測定はオペレータの作業が中心になっており、生産性向上のためには人間の生産活動と製造装置でのウエハ処理サイクルの整合をとることが重要でもある。
【０００６】しかも、この工程はウエハプロセスの微細化に伴い今後もますます重要となってくることが予想されている。本発明はこのような点に着目してなされたものであり、半導体ウエハプロセスにおける検査や測定工程について、作業の形態を変えてウエハプロセス向上としての生産性を向上させようとしたものである。
【０００７】
【課題を解決するための手段】本発明の第１の手段は、半導体の表面画像を撮影する撮影手段と、半導体処理の履歴情報を入力する履歴入力手段と、撮影手段により得られた撮影画像を格納する画像データ領域と、履歴入力手段により入力された半導体処理履歴を文字情報として格納する履歴データ領域と、これらの画像データ領域と履歴データ領域とを関連付けるテーブルとを備えたデータベースと、通信回線を介して接続されたホスト手段と端末手段とからなり、前記ホスト手段は、前記端末手段から履歴情報の照会があったときに前記データベースを検索して該当する半導体の処理履歴を端末手段に出力する半導体製造工程管理システムである。
【０００８】半導体の処理履歴情報と画面情報とをテーブルにより関連付けて管理しておくことにより、必要に応じて検査の妥当性を検討したり、あるいは撮影工程と検査工程とを時間的に分けて、検査工程は別室で端末手段の表示画面を参照して効率的に行うことができる。
【０００９】第２の手段は、前記ホスト手段において、端末手段から照会があったときにデータベースを検索して該当する半導体の処理履歴を端末手段に出力するステップと、前記処理履歴を端末手段上に表示しながら画像情報要求を受け付け、当該画像情報要求を受信したときには前記データベースを検索して前記処理履歴情報に対応した画像データを索出し、前記処理履歴情報とともに画像データを前記端末手段上に表示させるステップを順次実行するものである。
【００１０】すなわち、表示端末上で文字情報のみで処理履歴を参照し、必要に応じて画像情報をホスト手段か

ら取り寄せることにより、不必要な画像情報の表示に起因する処理効率の低下が防止できる。

【００１１】第３の手段は、前記データベースに格納された履歴データに、検査が完了したか否かのフラグを含ませたものである。撮影工程と検査工程を時間的に分けた場合に、当該フラグにより検査の有無が明確になる。

【００１２】第４の手段は、前記フラグは、前記端末手段に表示された処理履歴および画像データを参照しながら書き換え可能とした。すなわち、表示端末上で処理履歴と画像データを参照しながら外観検査等の検査を実行した後に、表示端末上から直接フラグを書き換えるようにした。

【００１３】第５の手段は、前記ホスト手段を、半導体搬送系制御手段と通信回線で接続し、前記端末手段からの要求に応じて半導体搬送系を作動させるようにした。搬送系と連動させることにより、ウエハの搬送をホスト手段で制御できるため、自動位置出しや画像の取り込みを自動化できる。

【００１４】第６の手段は、前記第１の手段において、半導体製造工程管理システムは、操査電子顕微鏡を備えた半導体表面の回路パターン寸法測定装置を備えており、当該操査電子顕微鏡を通じて実行された測定結果と測定画像とを前記データベースにおける履歴データと画像データとして格納するようにしたものである。

【００１５】このように測長工程においても、測定作業の履歴情報と回路パターンの画像イメージ情報とを同時に扱うことができ、測長作業の効率が大幅に向上するとともに、測長精度を高めることができる。

【００１６】

【発明の実施の形態】本発明の実施形態を図に基づいて説明する。

【００１７】

【実施例１】図１は半導体ウエハプロセス工場における生産自動化システムの概略制御系統図、図２は半導体ウエハプロセスの工程フロー図、図３は半導体製造時に使用するロット処理作業履歴の表示画面、図４は作業処理履歴表示を行う場合の概略説明図、図５はウエハ外観検査装置を示す説明図である。

【００１８】図１において、１は半導体工程管理用データサーバであり、工程全体を管理するホストサーバとして機能する。すなわち、半導体工程管理用データサーバ１は、各生産ウエハロットの処理工程手順や処理条件およびウエハ処理後の収集データを扱い、かつ情報の保管を行う。また、該サーバ１は、前記管理のために大容量記憶装置で構成されたデータベース２を有している。

【００１９】前記データベース２の構成を示したものが図２０である。データベース２は、ロットＩＤをキーにして、ウエハ履歴データの格納アドレスとウエハ画像データの格納アドレスとが対応付けられたインデックステーブル２００１を有している。

【００２０】データベース２内のウエハ履歴データ２００２には、図３に示すような半導体製造工程における処理履歴がテキストデータとして格納されている。また、ウエハ画像データ２００３には、後述の外観検査装置２０等で得られたウエハ表面の画像データが格納されている。このようにインデックステーブル２００１によってウエハ履歴データ２００２とウエハ画像データ２００３とが関連付けられて管理されている。

【００２１】前記半導体工程管理用データサーバ１は、ＬＡＮ３に接続されており、当該ＬＡＮ３には要所要所において通信ネットワーク用ブリッジ４を介して製造工程の１エリアを管理する自動化用エリアコンピュータ５と接続されている。

【００２２】自動化用エリアコンピュータ５には、リピータ７を介して半導体工程管理用表示端末１０（図４参照）が接続されている。さらにターミナルサーバ６を介して各種の製造装置８、測定機・検査装置９が接続されている。さらに、自動化用エリアコンピュータ５は、搬送コントローラ１１と接続され該搬送コントローラ１１は搬送制御用ＬＡＮに接続されている。

【００２３】上記システム構成において、半導体ウエハは搬送コントローラ１１により制御される搬送系を通じて製造装置８に搬送・移載される。そして、ウエハ処理条件が半導体工程管理用データサーバ１（ホスト）によってデータベース２からＬＡＮ３、ブリッジ４およびターミナルサーバ６を通して製造装置８に伝えられて処理が行われる。

【００２４】処理終了後のロット作業処理履歴情報および収集データは逆のルートでデータベース２に格納された後にデータを必要とする各所で利用される。ウエハ処理後は通常ウエハ外観検査を行い次の処理工程に進む。図５はウエハ外観検査装置２０の構成を示したものである。このウエハ外観検査装置２０は図１では測定機・検査装置９に含まれており、前述の前記製造装置８と同様にターミナルサーバ６等を介して半導体工程管理用データサーバ１（ホスト）に接続されている。

【００２５】図３は、半導体製造時のロット毎の作業履歴であり、これは半導体工程管理用表示端末１０の表示画面上に表示されるようになっている。すなわち、ウエハ処理の途中で、処理の進捗の確認およびウエハ処理上何か問題が起きていないかをチェックするために、各ロットについてウエハ処理の作業履歴をオペレータが確認する必要がある。これらは従来技術では、各ウエハロットにランシート、あるいはロットトラベラと称すウエハ処理の作業履歴を記入したシートがロットと一緒に添付され、ウエハ処理を行う毎にオペレータが作業記録を記入していた。しかし、本実施例では、ウエハカセット１３に添付されたバーコード１４をバーコードリーダ１７で読み取り、半導体工程管理用表示端末１０でロットを認識することによって、当該ウエハカセット１３に収容

されたウエハ１５の履歴を半導体工程管理用データベース２より呼び出して半導体工程管理用表示端末１０上の表示画面に呼び出すことによって、ウエハの作業履歴を簡単に確認できるようになっている。

【００２６】図３の表示画面にはロットの情報として製品名、枚数、現在の仕掛かり工程と過去の処理工程、処理装置、処理日時、処理条件、処理を行った作業者ＩＤ等の処理作業履歴情報および該ロットについてのこれからの処理工程フロー等が表示されている。

【００２７】なお、この半導体工程管理用表示端末１０は製造装置８のそばだけでなく、工場内通信ネットワーク（ＬＡＮ３）を通じて各所に設置可能であり、ＴＣＰ／ＩＰプロトコルを利用したイントラネットの構築により、各所で情報を確認することが可能である。さらに、ファイアウォール等のセキュリティが確立されていれば、外部から当該ＬＡＮ３にアクセスすることによって、インターネット技術を通じて全世界から情報を確認することも可能となる。

【００２８】図５は、半導体ウエハプロセスに用いられるウエハ外観検査装置２０の概要である。同図中２１はウエハ検査ステージであり、検査用ウエハカセット２３よりウエハ受け渡しアーム２８によって支持されたウエハが載置される。このウエハ検査ステージ２１の上方にはウエハ検査画像カメラ３１が配置され、撮影画像が顕微鏡２２により観察可能となっている。

【００２９】２５はウエハ移送部であり、軌道上を前述のウエハ受け渡しアーム２８およびウエハフィーダ２６が同図中水平方向に移動可能となっている。２４は不良ウエハ収納カセットであり、検査の結果不良と判断されたウエハが当該カセット２４に収納される。２７はウエハプリアライメントステージであり、ジョイスティック２９の操作によりウエハ検査ステージ２１上のウエハを検査に最適な位置に微調整することが可能となっている。３０は検査結果入力部であり、オペレータが外観検査結果を入力するための入力キーが配置されている。３２はモニタであり、前記ウエハ検査画像カメラ３１の撮影画像が表示可能となっている。３３はホスト通信用ネットワーク回線であり、ターミナルサーバ６を通じて半導体工程管理用データサーバ１（ホスト）に検査データを送受信可能となっている。

【００３０】図６はこのときの外観検査におけるホストとの通信シーケンスを表したものである。まず、各ウエハカセット２３が外観検査装置２０にセットされ、外観検査装置２０のそばの半導体工程管理用表示端末１０のバーコードリーダ１７を通じてカセットＩＤが読み込まれると（６０１）、当該ＩＤが通信ネットワーク３３を介して半導体工程管理用データサーバ１（ホスト）に送られる。

【００３１】半導体工程管理用データサーバ１（ホスト）では、当該カセット内のロットの工程チェックを行い（６０２）、この結果が正しければ（６０３）ロットＩＤ、ロット情報とともに検査レシピをウエハ外観検査装置２０に送る。

【００３２】外観検査装置２０では、前記情報を受信すると半導体工程管理用データサーバ１（ホスト）に検査開始を通知するとともに検査レシピにしたがって検査ウエハを検査ステージ２１にセットする（６０４）。次に、ウエアの位置出しを行い（６０５）、検査結果入力部３０で入力される検査結果と、ウエハ検査画像カメラ３１で撮影されたウエハ画像を取り込む（６０６，６０７）。これは具体的には、検査結果として良／不良および不良カテゴリィコードの判断が行われ、結果が検査結果入力部３０から入力されることによって行われる。そして、この検査結果とウエハ画像とを半導体工程管理用データサーバ１（ホスト）に送る。これらのデータを受信した半導体工程管理用データサーバ１（ホスト）では、当該データをデータベース２に格納する（６０８）。ウエハ外観検査装置２０では、引き続き前記ステップ６０４～６０８で説明した処理を繰り返す（６０９）。そしてウエハ外観検査装置２０からロットの検査終了が通知され、オペレータにより半導体工程管理用表示端末１０から検査完了コマンドが入力されることによりウエハ外観検査が終了する（６１０）。

【００３３】このように、本実施例では、オペレータにより入力された検査結果とともに、ウエハ画像イメージデータの取得を可能にし、このウエハ画像イメージデータを外観検査結果のデータ（テキストデータ）とともにデータベース２に格納しておくため、後から検査情報を視覚的に把握することができる。

【００３４】つまり、従来の外観検査時のウエハ外観は外観検査装置を使用したオペレータしか見ることができず、オペレータの注意を喚起する現象については検査作業処理履歴上にオペレータのコメントを残すことで他の人間に情報伝達を行ってきた。しかし、本実施例のように検査作業の処理履歴情報および作業者のコメント情報とともに検査ウエハの画像イメージデータを検査作業履歴として扱えるようにすることにより、ウエハ処理に対する検査情報は飛躍的に増加する。

【００３５】

【実施例２】図７はウエハ外観検査作業の検査作業処理履歴の表示画面を示したものである。すなわち、実施例１で取得した検査ウエハの画像イメージデータを半導体工程管理用表示端末１０の表示画面１６上に表示したものが同図である。

【００３６】図７に示すように、表示画面１６では外観検査作業が終了しているか、まだ未終了かを表す表示エリア（表示画面中左側）がある。また、ウエハ外観検査結果および不良カテゴリィコードの表示エリアはオペレータにより書き換え可能となっている。

【００３７】図８はウエハ外観作業の履歴情報を表示す

る場合のシーケンスを示す。工場内の後工程に係るオペレータや、居室のエンジニアが作業処理履歴を見たい場合（ステップ８０１）には、まず半導体工程管理用表示端末１０のバーコードリーダ１７を使用してウエハカセット１３のバーコード１４を読み込む。半導体工程管理用表示端末１０は読み込んだバーコードからカセットＩＤを抽出し、このカセットＩＤを半導体工程管理用データサーバ１（ホスト）に送信する。

【００３８】半導体工程管理用データサーバ１（ホスト）では当該カセットＩＤを検索キーにしてデータベース２を検索する。そして、索出された情報から当該カセットＩＤの工程処理作業履歴情報を作成し（８０２）、この履歴情報を半導体工程管理用表示端末１０に送信する。半導体工程管理用表示端末１０ではこのようにして受信した当該カセットＩＤのロットの工程処理作業履歴を表示画面１６に表示する。ここでの表示はまだテキストデータが中心であり、図３に示したような履歴情報である。

【００３９】これに対して検査担当者より検査工程の詳細情報の要求がなされたときには、半導体工程管理用データサーバ１（ホスト）はウエハ外観検査工程の処理作業履歴情報とウエハ画像イメージデータとを表示画面として作成し（８０４）、この画面データを半導体工程管理用表示端末１０に送信する。これにより図７に示したウエハ画像イメージデータが表示画面１６上に表示される（８０５）。

【００４０】このウエハ画像イメージデータを見ながら検査担当者が検査結果のチェックを行い（８０６）、その結果を入力する。この結果入力があった場合、半導体工程管理用表示端末１０では検査結果、不良カテゴリィ等取得後検査完了フラグをセットする（８０８）。そして、更新データを半導体工程管理用データサーバ１（ホスト）に送る。半導体工程管理用データサーバ１（ホスト）では、この更新データに基づいてデータベース２を更新する（８０９）。

【００４１】このように、本実施例では、任意のタイミングで検査作業処理履歴の情報を必要とする検査担当者は半導体工程管理用データサーバ１（ホスト）と連係した半導体工程管理用表示端末１０でウエハ画像イメージと作業履歴が同時に確認することが可能となり、検査の後工程でのウエハ処理条件の微調整への利用や複数人数による情報共有化により生産ライン品質上の問題に関する対策スピードアップ等大きな効果が期待できる。

【００４２】さらに、外観検査機にウエハカセット１３がセットされたタイミングで外観検査結果を判断しなくても、別のタイミングで検査結果や不良カテゴリィの判断が可能となる。

【００４３】このことは、試作等で特別な判断知識が必要な場合等、検査機の操作オペレータと検査担当者を分離できるので技術者待ち等の時間節約や夜間の操業等工場全体の生産性向上が期待できる。

【００４４】

【実施例３】図９は測長機に使用される半導体用走査電子顕微鏡の概要である。同図において、測長機４０１として用いられる走査電子顕微鏡４０は、本体４１と、ウエハカセットオートローダ４２と、コントロールユニット４３および操作部４４で構成されている。また、この操作電子顕微鏡４０は、スキャンコンバータ４８ａ，パターン認識部４８ｂおよび基準パターン保存部４８ｃとからなる自動位置出しユニット４８を有している。この自動位置出しユニット４８は、測長を行う回路パターンに対し予め基準パターンを保持しておき、実際の回路パターンとの比較を行いそのＸ－Ｙ座標のズレ量を計測して測長部本体に伝え、ズレを補正して測長する回路パターンの位置出しを行うものである。

【００４５】操作電子顕微鏡４０の画像はカメラ４５によって撮影され、モニタ４６の表示画面に表示されるとともに、ネットワーク回線を通じて半導体工程管理用データサーバ１（ホスト）に送られる。

【００４６】次に、図１０に測長工程におけるホストとの通信シーケンスを示す。まず、図９のウエハカセットオートローダ４２にウエハカセット１３がセットされ、測長機４０１のそばの半導体工程管理用表示端末１０のバーコードリーダ１７によりカセットＩＤが読まれて（１００１）、これが半導体工程管理用データサーバ１（ホスト）に送られる。半導体工程管理用データサーバ１（ホスト）では、データベース２を参照して該当するカセット内のロットの工程チェックを行い（１００２）、当該チェックの結果が正しければ（１００３）、ロットＩＤ、ロット情報および測定レシピを通信ネットワーク回線４７を介して測長機４０１に送る。

【００４７】測長機４０１では、半導体工程管理用データサーバ１（ホスト）に測定開始を通知するとともに、前記測定レシピにしたがって測定用ウエハを測定ステージにセットし（１００４）、自動位置出しユニット４８によってウエハの位置出しを行い（１００５）、走査電子顕微鏡４０を用いた寸法測定作業により測定データを取得する（１００６）。この測定データの取得は具体的には、走査電子顕微鏡４０によって得られるウエハ面の回路パターン画像を画像と一緒に表示されるカーソルを使用して、オペレータがパターン寸法を測定することにより行う。

【００４８】このとき、カメラ４５で測長画像の取り込みを行い（１００７）、これらで得られた測定結果と測長画像を通信ネットワーク回線４７を通じて半導体工程管理用データサーバ１（ホスト）に送る。

【００４９】半導体工程管理用データサーバ１（ホスト）では、上記で得られた測定結果と測長画像とを履歴情報としてデータベース２に格納する（１００８）。そして測長機４０１ではウエハに対して次の位置での測長

が行われる（１００９）。この測長結果も前記ステップ１００４～１００８と同様に半導体工程管理用データサーバ１（ホスト）に送られる。

【００５０】測長工程の完了は、半導体工程管理用表示端末１０に完了コマンドが入力されることにより行われる（１０１０）。このように本実施例では、測長工程においても測定作業処理の履歴情報と回路パターンの画像イメージ情報を同時に扱うことで、測長時に得られる情報が飛躍的に増加する。

【００５１】次に、上記で得られた測長結果と測長画像との利用方法について説明する。図１１は半導体工程管理用表示端末１０に表示される測長工程の作業処理履歴の表示画面である。

【００５２】図１２は、いったん収集した測定作業処理履歴情報を表示するシーケンスを示している。測長の処理履歴についても、実施例２と同様に工場内の半導体工程管理用表示端末１０で任意のタイミングで任意の場所で、図１１のような表示画面が得ることができる。この詳細を図１２を用いて説明する。

【００５３】オペレータ（検査担当者）が処理ロットの工程処理作業履歴情報を取得したいときには（１２０１）、半導体工程管理用表示端末１０のバーコードリーダ１７で当該カセットＩＤを読み込む。このカセットＩＤが半導体工程管理用データサーバ１（ホスト）に送られるとデータベース２が検索されて工程処理作業履歴情報が作成され（１２０２）、表示情報（テキストデータ）として半導体工程管理用表示端末１０に送られる。オペレータは半導体工程管理用表示端末１０上に表示される履歴情報を参照する（１２０３）。このときの履歴情報は図３に示した形式となっている。そしてオペレータが測長工程についてさらに詳細な情報が必要な場合には半導体工程管理用表示端末１０上で詳細情報または画像情報を指示することによって、測長工程詳細情報要求が半導体工程管理用データサーバ１（ホスト）に送られる。半導体工程管理用データサーバ１（ホスト）では、この要求を受け付けるとデータベース２を検索して、寸法測定工程の処理作業履歴情報と各ウエハの測長画像イメージ情報とを表示画面として作成し（１２０４）、これを半導体工程管理用表示端末１０に送る。

【００５４】このようにして半導体工程管理用表示端末１０上には図１１に示した情報が表示される（１２０５）。オペレータ（検査担当者）は、この測長結果をチェックし（１２０６）、さらに寸法入力が必要な場合には半導体工程管理用表示端末１０の検査結果入力部３０より寸法データの入力を行う。

【００５５】半導体工程管理用表示端末１０では、この寸法データの入力が行われた場合には、当該測長寸法データを半導体工程管理用データサーバ１（ホスト）に送信する（１２０７，１２０８）。当該測長寸法データを受信した半導体工程管理用データサーバ１（ホスト）ではデータベース２を更新して処理を完了する。

【００５６】このように、本実施例では、測長工程においても測定作業処理の履歴情報と回路パターンの画像イメージ情報を同時に扱えることで、後工程での処理条件の微調整や同一情報の共有化によるライン品質評価のスピードアップおよび精度向上等に効果が期待できる。

【００５７】また、測長機４０１にウエハカセット１３がセットされたタイミングで寸法測定を行わなくても、別のタイミングで寸法測定ができるようになる。寸法測定に関しても、実施例２と同様に測長機４０１の操作オペレータと寸法測定員を分離でき、工場の生産性向上を実現できる。

【００５８】

【実施例４】図１３はウエハ外観や測長回路パターンの画像イメージの表示画面である。本実施例では、ロット単位でのウエハの画像イメージを一覧できるようになっている。

【００５９】また、図１４はウエハ外観や測長回路パターンの画像イメージを表示端末に表示して、各種の調査を行う場合の通信シーケンスである。以下、図１４を用いて本実施例の処理を詳細に説明する。

【００６０】オペレータ（検査担当者）やエンジニアが、調査のための処理ロットの画像表示を行いたいときには（１４０１）、半導体工程管理用表示端末１０のバーコードリーダ１７を用いてウエハカセット１３のバーコード１４をスキャンする。半導体工程管理用表示端末１０はこのようにして取得したカセットＩＤを半導体工程管理用データサーバ１（ホスト）に送信する。

【００６１】半導体工程管理用データサーバ１（ホスト）では、データベース２を検索して、要求されたロットの工程フローより要求画像設定表示情報を生成し（１４０２）、半導体工程管理用表示端末１０に送信する。

【００６２】半導体工程管理用表示端末１０では、前記要求画像設定表示情報を表示する（１４０３）。ここで、オペレータが要求画像を設定したい場合、たとえば工程フローにしたがったある一連のウエハ外観の画像を時系列的に表示させたい場合、半導体工程管理用表示端末１０を通じて画像表示要求を半導体工程管理用データサーバ１（ホスト）に送信する。

【００６３】前記画像表示要求を受信した半導体工程管理用データサーバ１（ホスト）では、データベース２を検索して当該一連のウエハに関する画像を収集し、表示画面を作成する（１４０５，１４０６）。そして作成された表示画面を半導体工程管理用表示端末１０に送信し、表示する（１４０７）。この結果、表示された画像が図１３に示したものである。同図では、ウエハ画像が時系列的に一覧表示されているため、半導体製品の品質トラブルの解析が極めて容易になる。また、今まで扱うことが困難であったウエハ面や回路パターンの画像情報をウエハ処理履歴とともに扱えるのでユーザクレームに

対し製品の品質を保証するための有力なる情報となる。

【００６４】

【実施例５】図１５はウエハプロセス工場のウエハ自動搬送システムの概要図であり、図１６はその中の測長機における工程内搬送状態を示す説明図である。

【００６５】図中、５０は工程間搬送路であり、５１は自動倉庫（ストッカ）、５２は自動倉庫移動ステーションである。また、５３は自動倉庫ＡＧＶポートであり、ＡＧＶ５４との間でウエハカセット１３のやりとりを行う。

【００６６】５５は、ＡＧＶベイ内搬送路であり、このベイ内搬送路５５に沿ってその外周に製造装置５６，ウエハ外観検査装置５７および測長機５８が配置されている。図１６に示すように、測長機５８は無人化に対応するために図９で説明した自動位置出しユニット４８を有している。この自動位置出しユニット４８は、測長を行う回路パターンに対し予め基準パターンを保持しておき、実際の回路パターンとの比較を行いそのＸ－Ｙ座標のズレ量を計測して測長部本体に伝え、ズレを補正して測長する回路パターンの位置出しを行うものである。

【００６７】また、ＡＧＶ５４にはロボットアーム６２が設けられており、測長機４０１の測長ウエハカセット６１をウエハカセット置場６３側に移載できるようになっている。

【００６８】図１７はウエハプロセス工場の測長工程を無人で生産するシステムの通信シーケンスを示している。まず、測長機４０１は測長できる状態にある場合半導体工程管理用データサーバ１（ホスト）にロット情報の要求を出力する。半導体工程管理用データサーバ１（ホスト）は測長機４０１からの要求を受けてその測長機４０１で測定可能なロットを工場内の仕掛かりロットから検索する（１７０１）。

【００６９】ここで、測長できるロットがある場合（１７０２）は搬送系を制御する搬送コントローラ１１に対し、そのロットを測長機４０１まで搬送・移載するように指令を出す（１７０３）。

【００７０】搬送コントローラ１１は、測定ロットを該当する測長機４０１に搬送するように自動倉庫移動ステーション５２，ＡＧＶ５４等を作動させる（１７０４）。そしてさらに、図１６に示したＡＧＶ５４のロボットアーム６２の作動により、測長機４０１に測定ロットがセットされると（１７０５）、搬送コントローラより半導体工程管理用データサーバ１（ホスト）に搬送完了が通知される。それとともに、測長機４０１から半導体工程管理用データサーバ１（ホスト）に対して測定ロットのロット情報問い合わせが行われ、これに対して半導体工程管理用データサーバ１（ホスト）はロット情報および測定レシピを測長機４０１に通知する。

【００７１】測長機４０１では、前記レシピにしたがってウエハ面の特定ポイントの回路パターンの位置出しを行い測長画像を取り込む（１７０６，１７０７）。そして、このウエハ測定位置情報と測長画像イメージ情報を半導体工程管理用データサーバ１（ホスト）に送信する。そして、半導体工程管理用データサーバ１（ホスト）に対し寸法測定は実施していないことを伝えるために移動画像取り込みフラグをセットし合わせて送信する（１７０８，１７０９）。ロットの測長画像の取り込みが終了すると、測長機４０１はロットを次工程に進めるためにロット測定完了通知とロットの次工程への搬送要求を半導体工程管理用データサーバ１（ホスト）に伝える。

【００７２】半導体工程管理用データサーバ１（ホスト）はこの通知を受け次工程を検索し（１７１１）、測長ロットを次工程へ搬送するための搬送指示を搬送コントローラ１１に出力する。これに基づいて搬送コントローラ１１は、測定済みロットの自動移載を指示し（１７１２）、当該ロットを次工程に搬送する（１７１２）。

【００７３】本実施例では、以上説明したように、オペレータの介在なしで測長工程の処理が終了し、ウエハロットは次の工程の処理待ち状態となる。一方、検査工程の場合も自動位置出し機能を持つ検査装置を使用することで上記と同様の動作が可能である。

【００７４】図１９はこのようにして得られた測長回路パターン画像を別のタイミングで寸法測定する場合のシーケンスである。たとえばウエハ処理を行うクリーンルーム以外の居室等に寸法測定員がおり、測長工程にて測長回路パターン画像が取り込まれているロットを表示端末を利用してホストに問い合わせる場合を説明する。

【００７５】居室のオペレータが寸法測定を行いたい場合（１９０１）には、まず当該要求を半導体工程管理用表示端末１０より入力する。この要求が半導体工程管理用データサーバ１（ホスト）に到着すると、半導体工程管理用データサーバ１（ホスト）はデータベース２を検索し（１９０２）、該当するロット情報を半導体工程管理用表示端末１０に送信・表示させる（１９０３）。

【００７６】オペレータが半導体工程管理用表示端末１０に表示されたロットから測長を行うロットを選択する場合（１９０４）、半導体工程管理用表示端末１０に対して測定ロットのＩＤを入力する。当該ＩＤが、半導体工程管理用表示端末１０を経由して半導体工程管理用データサーバ１（ホスト）に受信されると、半導体工程管理用データサーバ１（ホスト）はデータベース２を検索して当該測定ロットの作業履歴情報と測長画像とを抽出する（１９０５）。そして得られた測長画像を半導体工程管理用表示端末１０に送信し、半導体工程管理用表示端末１０の表示画面上に当該画像が表示される（１９０６）。

【００７７】オペレータは、半導体工程管理用表示端末１０に表示された画像に基づいて寸法測定を行い（１９０７）、この測定寸法値を半導体工程管理用表示端末１

0から入力する。このようにして入力された測定寸法値は測定完了のフラグとともに半導体工程管理用データサーバ1（ホスト）に送信される。半導体工程管理用データサーバ1（ホスト）では、データベース2の該当ロットについて測定寸法値を付加し、測定完了フラグをセット状態にする。

【0078】このように、本実施例では、測定レシピを受信し自動位置出し機能と工程内搬送対応機能を持つ測長機401の測長回路パターン画像を半導体工程管理用データサーバ1（ホスト）にて画像イメージ情報として格納しておく。したがって、通常のタイミングとは別のタイミングで寸法測定を行うことができ、測長機401が製造装置8と同じ場所にレイアウトされた半導体ウエハプロセス工場のクリーンルーム内でもオペレータなしで無人化ウエハプロセス生産が可能となる。

【0079】外観検査装置20に対しても同様の機能を持たせることにより外観検査装置20が製造装置8と同じ場所にレイアウトされても同様に無人化ウエハプロセスの生産が実現できる。

【0080】無人でのウエハプロセス生産により、ウエハ面のクリーン度の維持のみならず、今まで人間の作業では困難であった細かい生産処理スケジュールにしたがったウエハ処理が行え生産TAT短縮や平準化生産が計画通りに実現できる。

【0081】

【発明の効果】本発明によれば、検査作業の処理履歴情報および作業者のコメント情報とともに検査ウエハの画像イメージデータを検査作業履歴として扱えるようにすることにより、ウエハ処理に対する検査情報は飛躍的に増大させることができる。

【図面の簡単な説明】

【図1】 半導体ウエハプロセス工場における生産自動化システムの概略制御系統図

【図2】 半導体ウエハプロセスの工程フロー図

【図3】 半導体製造時に使用するロット処理作業履歴の表示画面

【図4】 半導体工程管理用表示端末上で作業処理履歴表示を行う場合の概略説明図

【図5】 ウエハ外観検査装置を示す説明図

【図6】 外観検査における半導体工程管理用データサーバとの通信手順を示したシーケンス図

【図7】 ウエハ外観検査作業の検査作業処理履歴の表示画面

【図8】 ウエハ外観作業の履歴情報を表示する場合のシーケンス図

【図9】 測長機に使用される半導体用走査電子顕微鏡の概要図

【図10】 測長工程における通信シーケンス図

【図11】 測長工程における作業処理履歴の表示画面図

【図12】 測長工程における作業処理履歴の表示シーケンス図

【図13】 ウエハ外観検査装置および測長画像の表示画面図

【図14】 ウエハ外観検査および測長画面調査時のシーケンス図

【図15】 ウエハ自動搬送システムを示す説明図

【図16】 測長機近辺のウエハ自動搬送システムの部分図

【図17】 半導体ウエハの無人生産システムにおける測長工程の通信シーケンス図（1）

【図18】 半導体ウエハの無人生産システムにおける測長工程の通信シーケンス図（2）

【図19】 半導体ウエハの無人生産システムにおける寸法測定シーケンス図

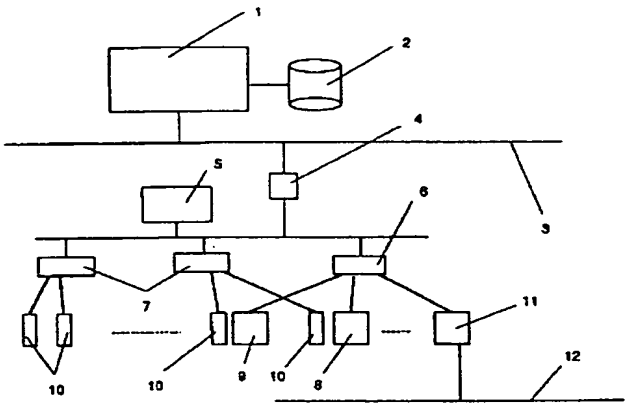
【図20】 データベースの内部構成を示すブロック図

【符号の説明】

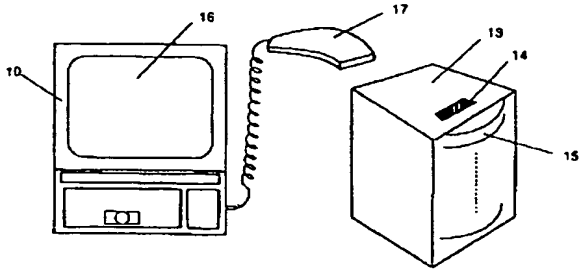
1 半導体工程管理用データサーバ（ホスト）
2 データベース
3 LAN
4 通信ネットワーク用ブリッジ
5 自動化用エリアコンピュータ
6 ターミナルサーバ
7 リピータ
8 製造装置
9 測定機・検査装置
10 半導体工程管理用表示端末
11 搬送コントローラ
12 搬送制御用LAN
13 ウエハカセット
14 バーコード
15 ウエハ
16 表示画面
17 バーコードリーダ
20 ウエハ外観検査装置
21 ウエハ検査ステージ
22 顕微鏡
23 検査用ウエハカセット
24 不良ウエハ収納カセット
25 ウエハ移送部
26 ウエハフィーダ
27 ウエハプリアライメントステージ
28 ウエハ受け渡しアーム
29 ウエハ検査用ジョイスティック
30 検査結果入力部
31 ウエハ検査画像カメラ
32 モニタ
33 ホスト通信用ネットワーク回線
40 走査電子顕微鏡
41 本体

42　ウエハカセットオートローダ
43　コントロールユニット
44　操作部
45　カメラ
46　モニタ
47　ホスト通信用ネットワーク回線
48　自動位置出しユニット
48a　スキャンコンバータ
48b　パターン認識装置
48c　基準パターン保存部

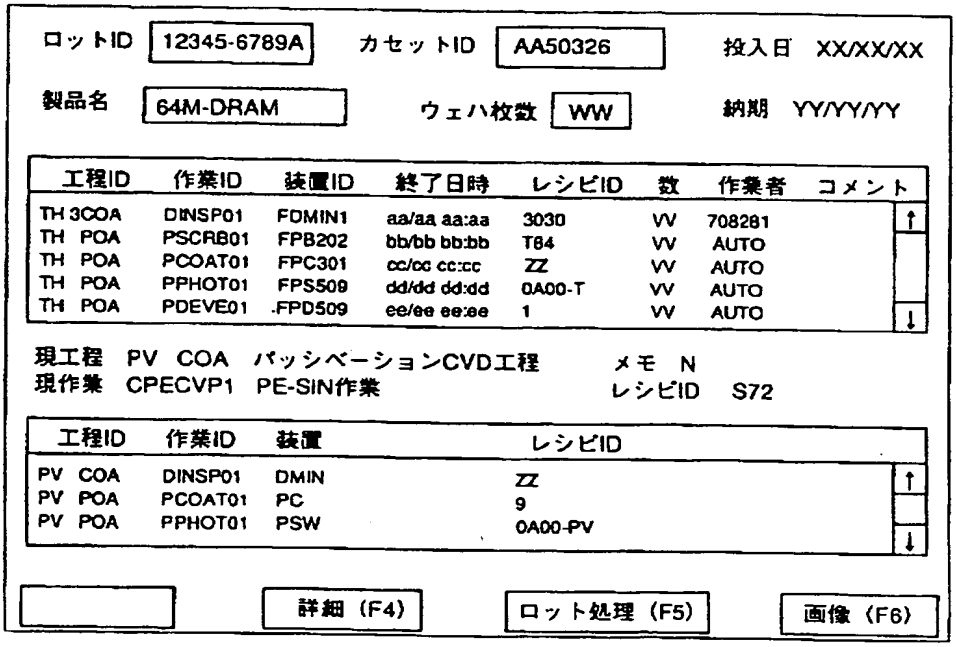
【図1】



【図4】



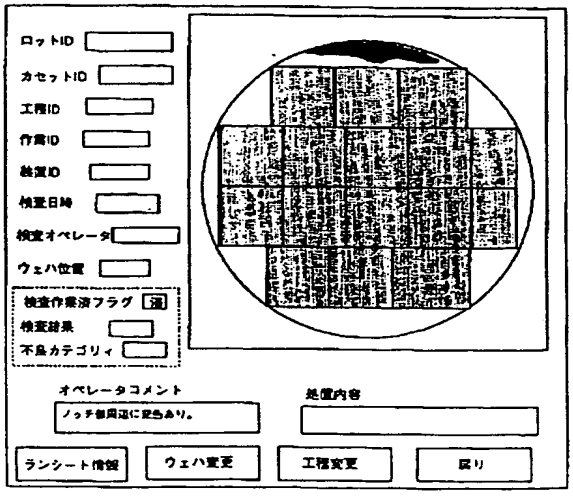
【図3】



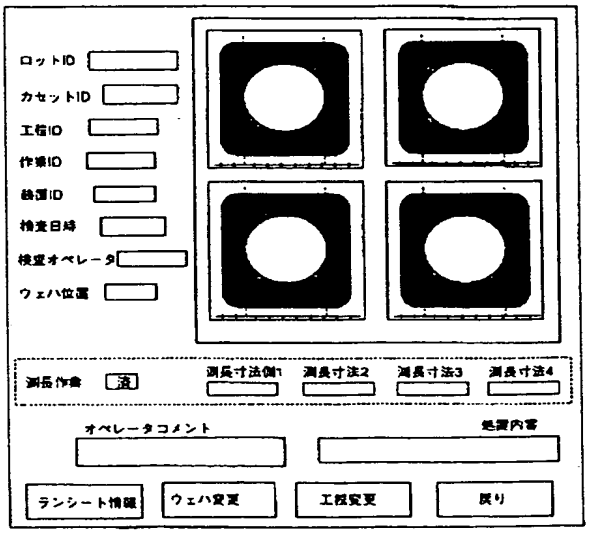
【図2】

工程ID	作業ID	工程名	作業名	処理条件
NW D01	WAFER01	プレ酸化工程	マーキング作業01	ZZ
NW D01	DBWRC01	プレ酸化工程	洗浄作業	RCA1-01
NW D01	DDIFFA1	プレ酸化工程	拡散作業A001	1ST-DXI
NW D01	DMERP01	プレ酸化工程	ルドルフ膜厚測定作業01	0010
NW P01	PCOAT01	Nウエルホトリソ	レジストコーティング作業01	6
NW P01	PPHOT01	Nウエルホトリソ	露光作業01	0100-NW
⋮	⋮	⋮	⋮	⋮
PV 1C03	DMPSM01	パッシベーションCVD	プリズム屈折率測定作業01	ZZ
PV 1C03	CPECVP1	パッシベーションCVD	PE - SIN作業	S71
PV 1C03	DINSP01	パッシベーションCVD	インスペクション作業01	007
PV P03	PSCRB01	パッシベーションホトリソ	コーティング前スクラバ作業01	1
PV P03	PCOAT01	パッシベーションホトリソ	レジストコーティング作業01	9
⋮	⋮	⋮	⋮	⋮

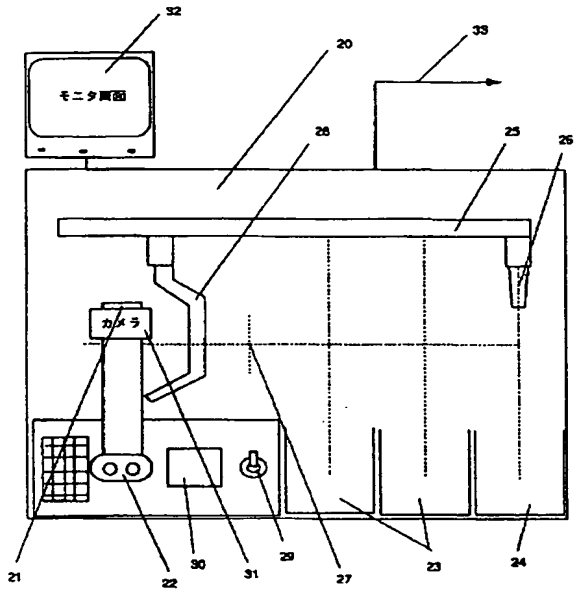
【図7】



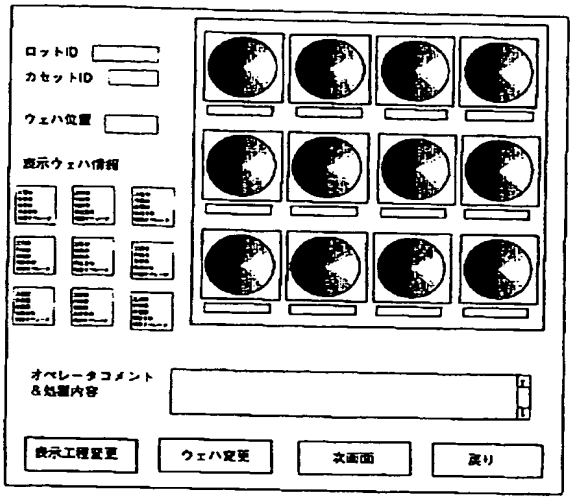
【図11】



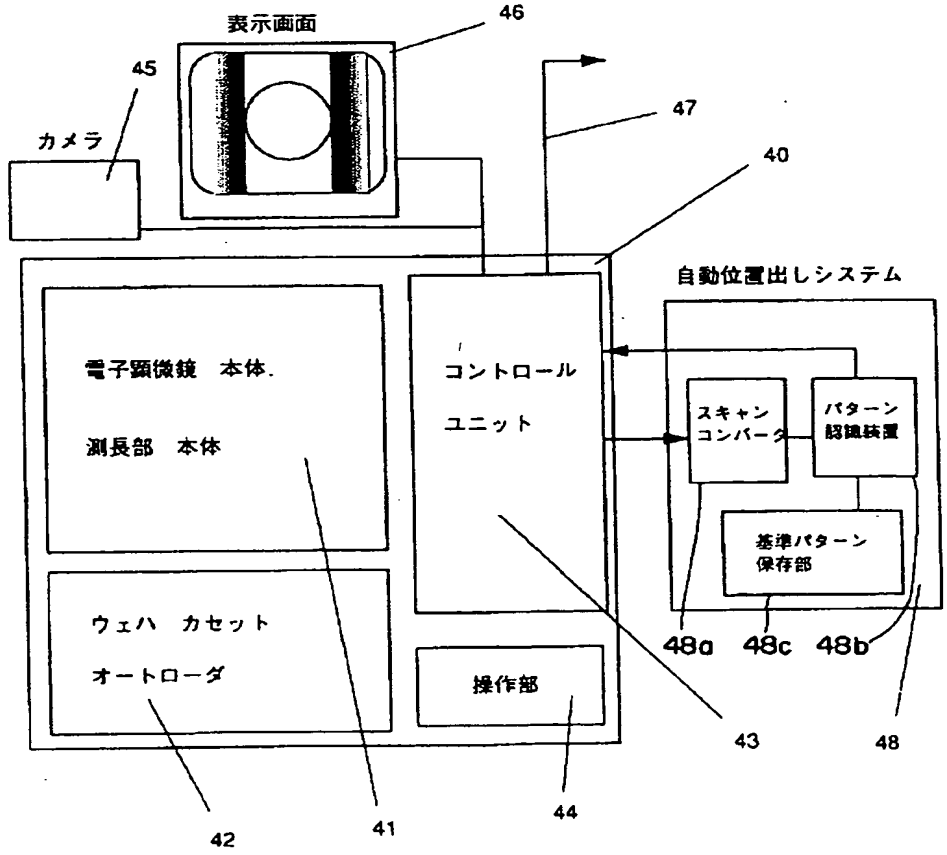
【図5】


32
モニタ画面
20
33
28
25
26
カメラ
21
22
30
31
29
27
23
24

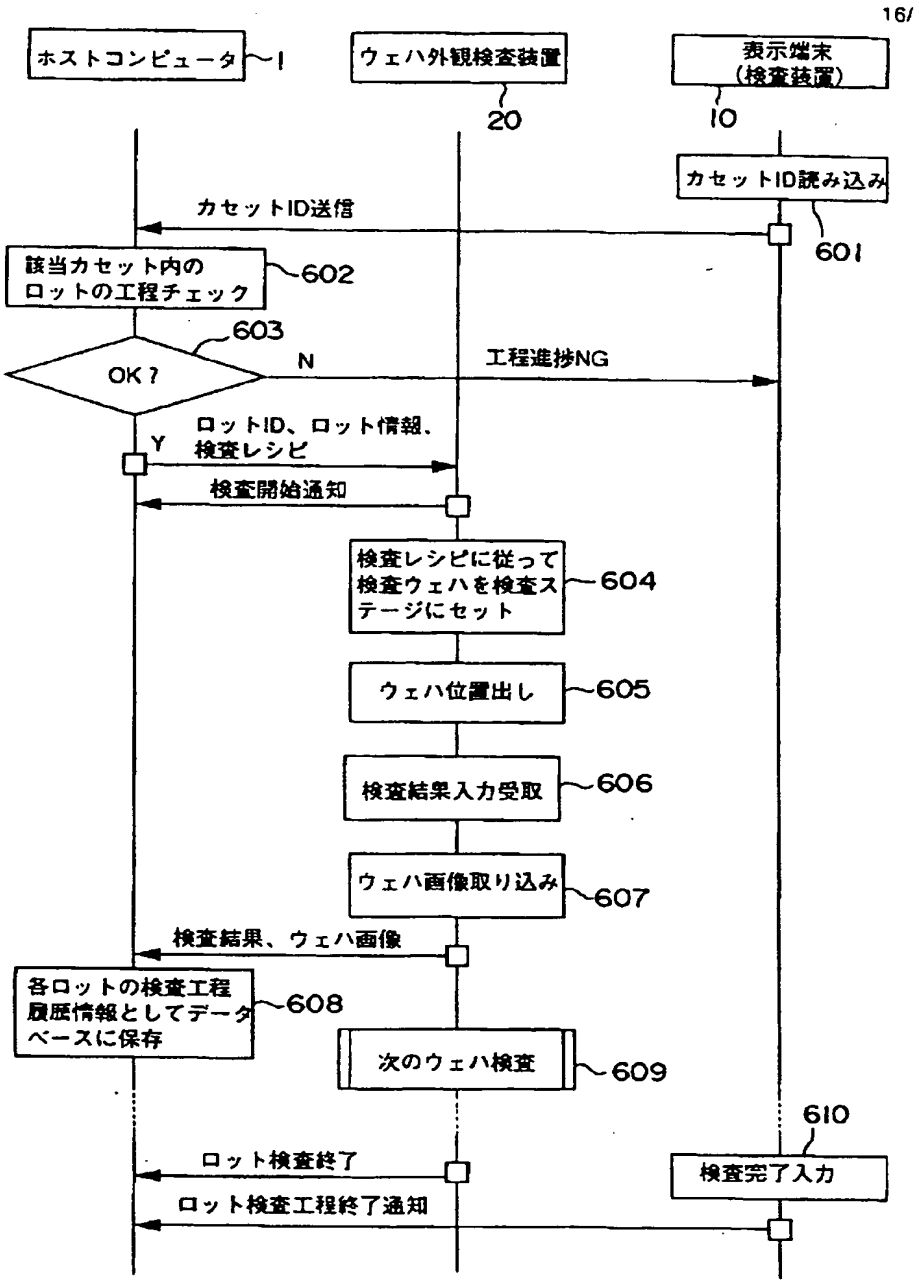
【図13】


ロットID
カセットID
ウェハ位置
表示ウェハ情報
オペレータコメント
&処置内容
表示工程変更
ウェハ変更
次画面
戻り

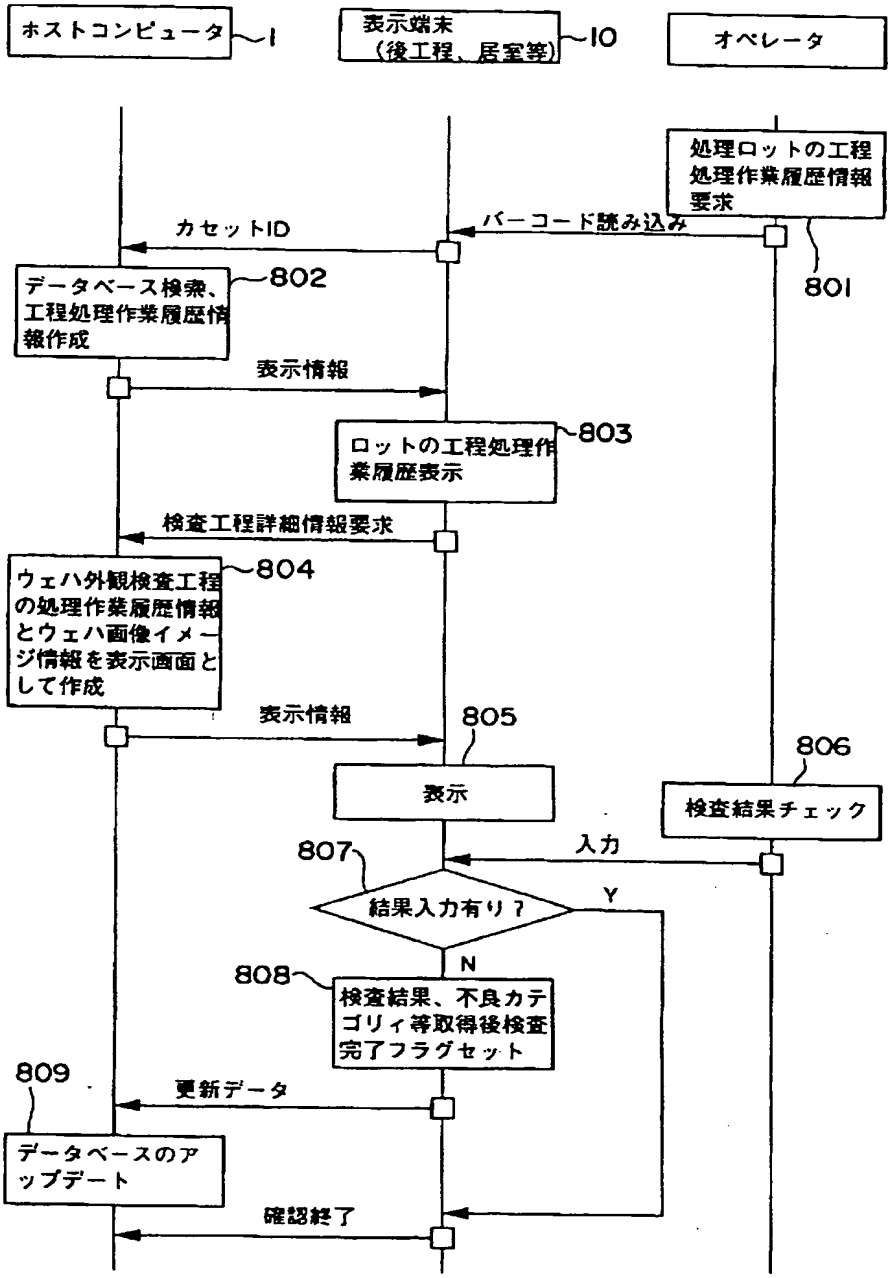
【図9】


表示画面
46
45
カメラ
47
40
自動位置出しシステム
電子顕微鏡　本体.
測長部　本体
コントロール
ユニット
スキャン
コンバータ
パターン
認識装置
基準パターン
保存部
ウェハ　カセット
オートローダ
操作部
48a
48c
48b
43
48
42
41
44

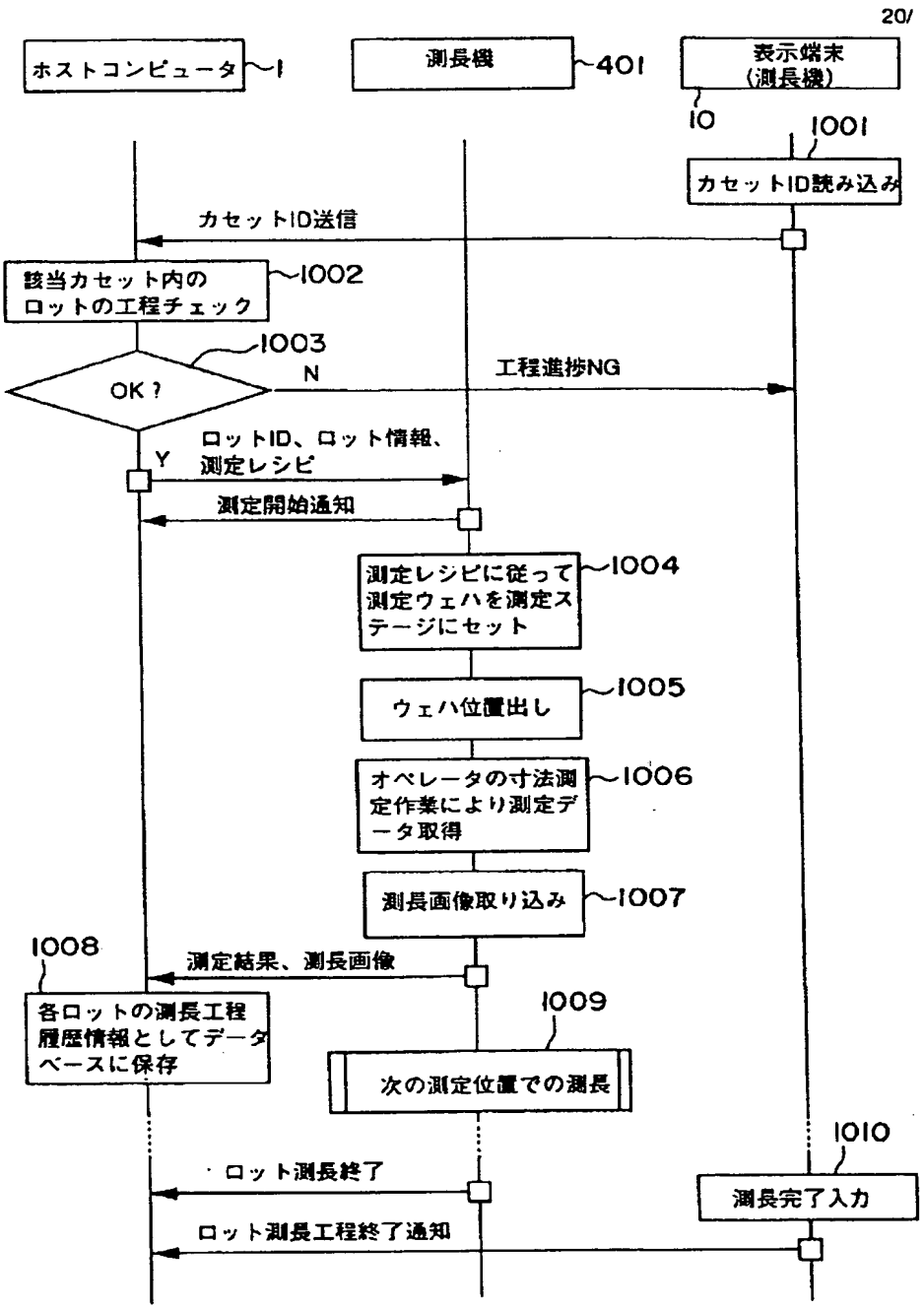
【図6】


16/
ホストコンピュータ
1
ウェハ外観検査装置
20
表示端末
（検査装置）
10
カセットID読み込み
601
カセットID送信
該当カセット内の
ロットの工程チェック
602
603
OK？
N
工程進捗NG
Y
ロットID、ロット情報、
検査レシピ
検査開始通知
検査レシピに従って
検査ウェハを検査ス
テージにセット
604
ウェハ位置出し
605
検査結果入力受取
606
ウェハ画像取り込み
607
検査結果、ウェハ画像
各ロットの検査工程
履歴情報としてデータ
ベースに保存
608
次のウェハ検査
609
610
ロット検査終了
検査完了入力
ロット検査工程終了通知

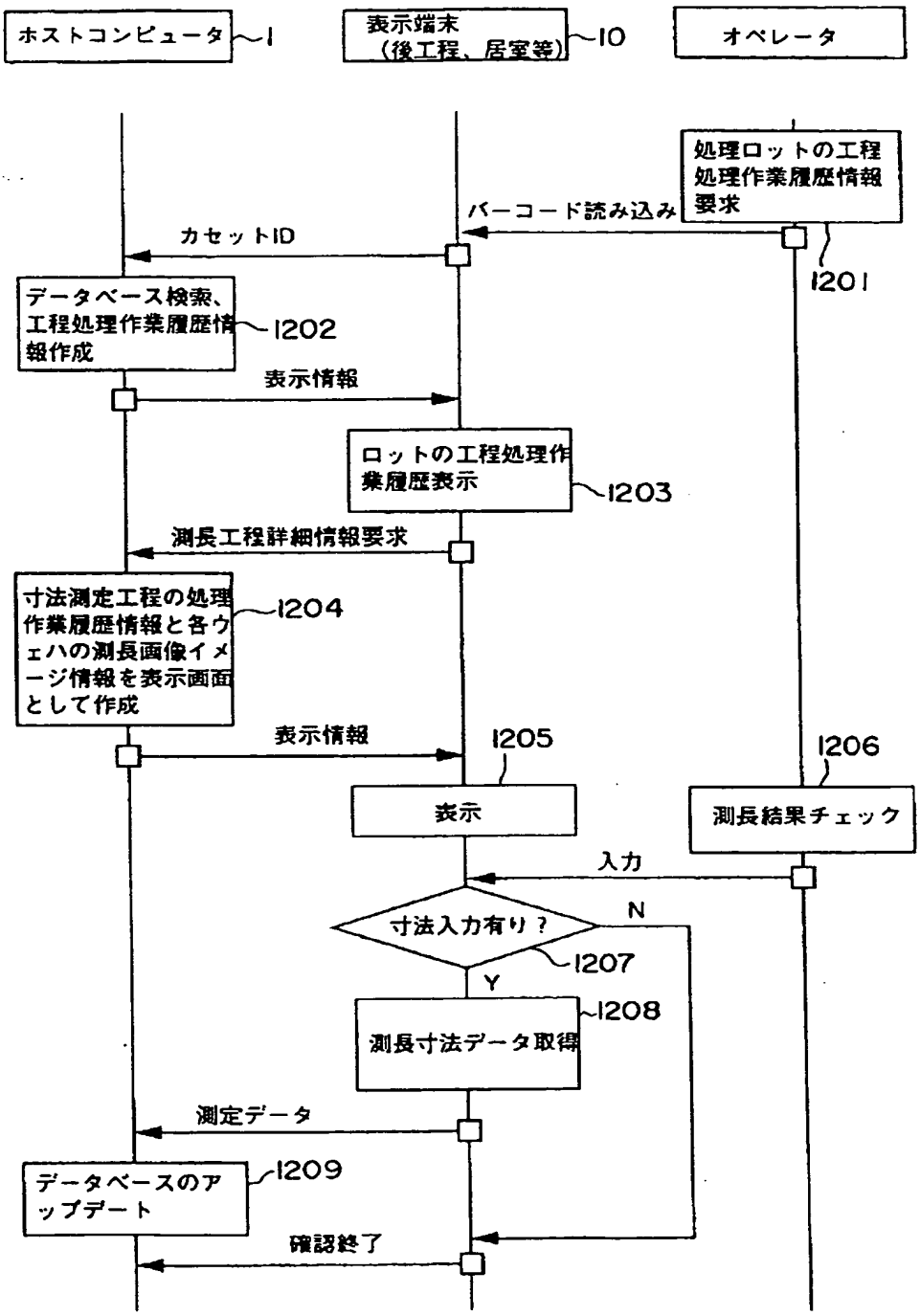
【図8】


ホストコンピュータ
1
表示端末
（後工程、居室等）
10
オペレータ
処理ロットの工程処理作業履歴情報要求
801
カセットID
バーコード読み込み
データベース検索、工程処理作業履歴情報作成
802
表示情報
ロットの工程処理作業履歴表示
803
検査工程詳細情報要求
ウェハ外観検査工程の処理作業履歴情報とウェハ画像イメージ情報を表示画面として作成
804
表示情報
805
表示
806
検査結果チェック
入力
807
結果入力有り？
Y
N
808
検査結果、不良カテゴリィ等取得後検査完了フラグセット
809
更新データ
データベースのアップデート
確認終了

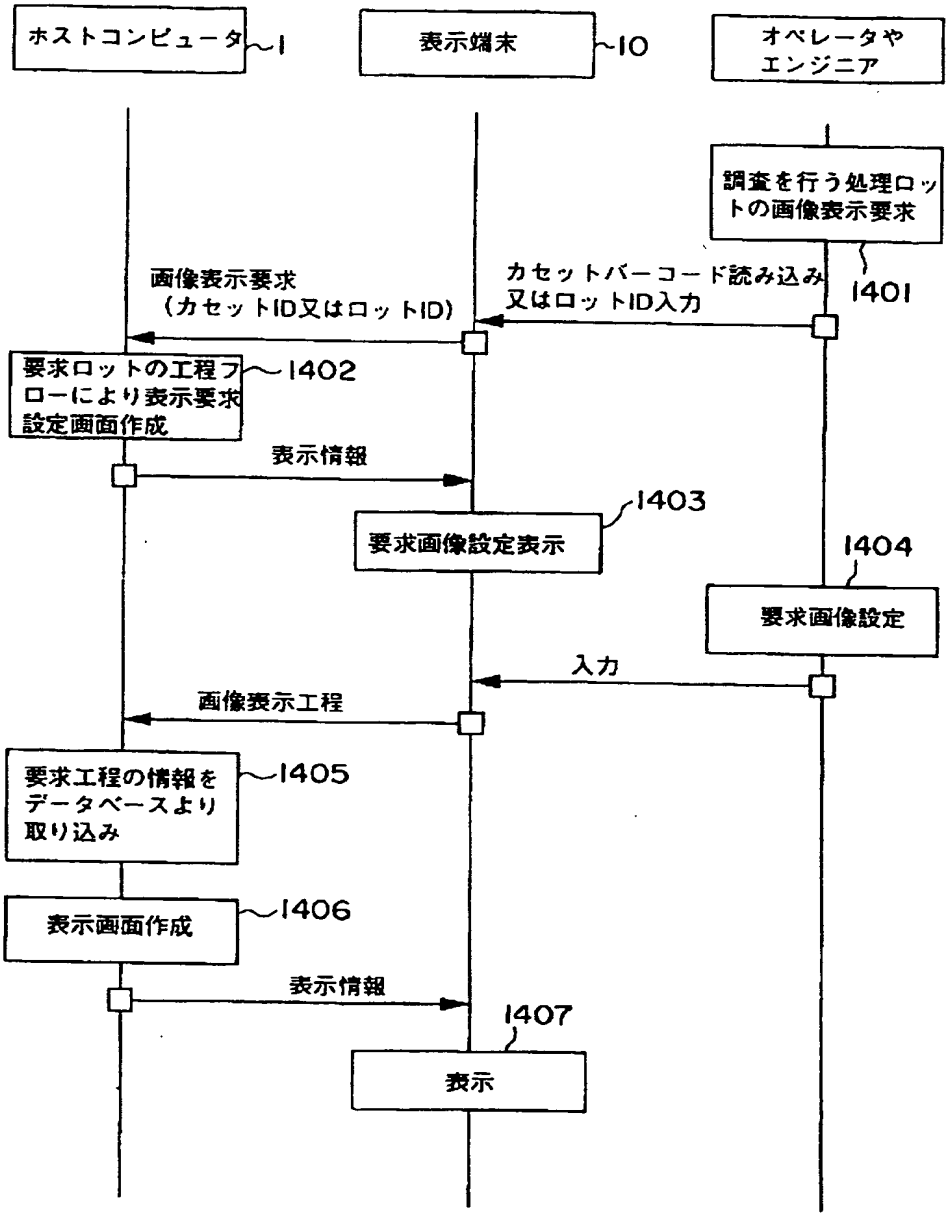
【図10】


20/
ホストコンピュータ
1
測長機
401
表示端末
（測長機）
10
1001
カセットID読み込み
カセットID送信
該当カセット内の
ロットの工程チェック
1002
1003
OK？
N
工程進捗NG
Y
ロットID、ロット情報、
測定レシピ
測定開始通知
測定レシピに従って
測定ウェハを測定ス
テージにセット
1004
ウェハ位置出し
1005
オペレータの寸法測
定作業により測定デ
ータ取得
1006
測長画像取り込み
1007
1008
測定結果、測長画像
各ロットの測長工程
履歴情報としてデータ
ベースに保存
1009
次の測定位置での測長
1010
ロット測長終了
測長完了入力
ロット測長工程終了通知

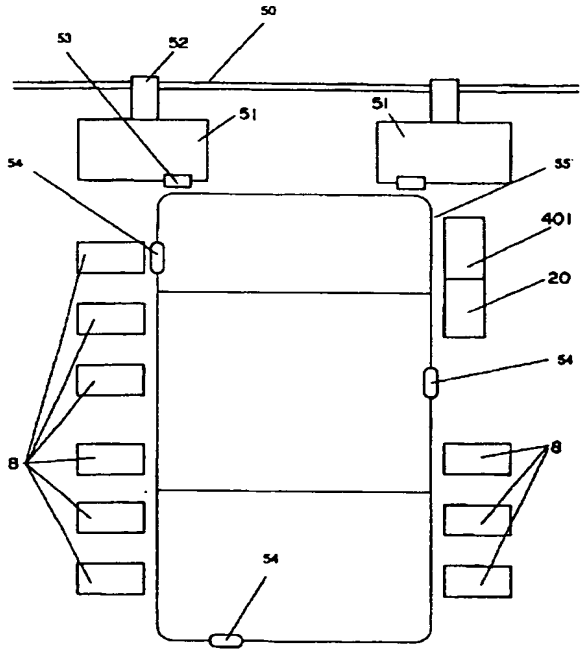
【図12】


ホストコンピュータ
1
表示端末
(後工程、居室等)
10
オペレータ
処理ロットの工程処理作業履歴情報要求
バーコード読み込み
カセットID
1201
データベース検索、工程処理作業履歴情報作成
1202
表示情報
ロットの工程処理作業履歴表示
1203
測長工程詳細情報要求
寸法測定工程の処理作業履歴情報と各ウェハの測長画像イメージ情報を表示画面として作成
1204
表示情報
1205
1206
表示
測長結果チェック
入力
寸法入力有り?
N
1207
Y
測長寸法データ取得
1208
測定データ
データベースのアップデート
1209
確認終了

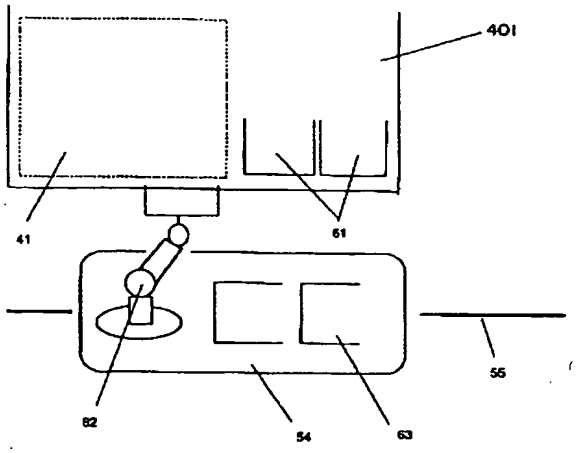
【図14】


ホストコンピュータ
1
表示端末
10
オペレータや
エンジニア
調査を行う処理ロットの画像表示要求
1401
画像表示要求
（カセットID又はロットID）
カセットバーコード読み込み
又はロットID入力
要求ロットの工程フローにより表示要求設定画面作成
1402
表示情報
1403
要求画像設定表示
1404
要求画像設定
入力
画像表示工程
要求工程の情報をデータベースより取り込み
1405
表示画面作成
1406
表示情報
1407
表示

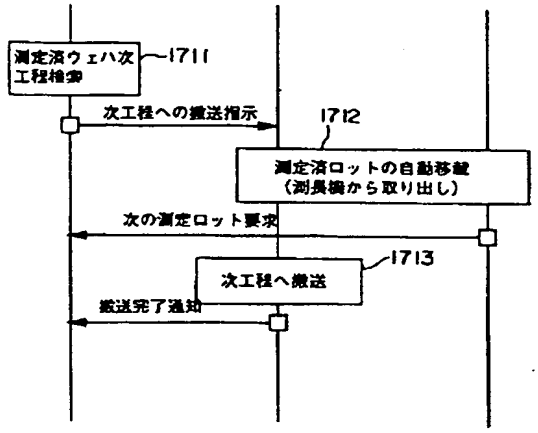
【図15】



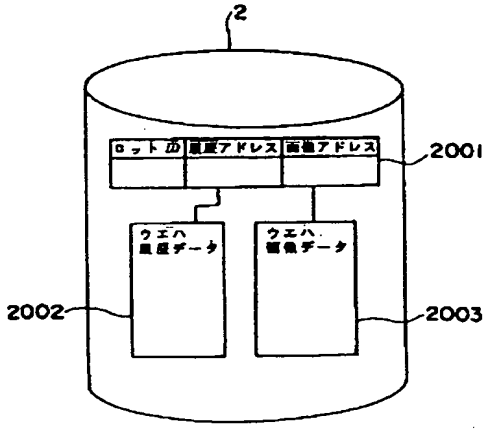
【図16】



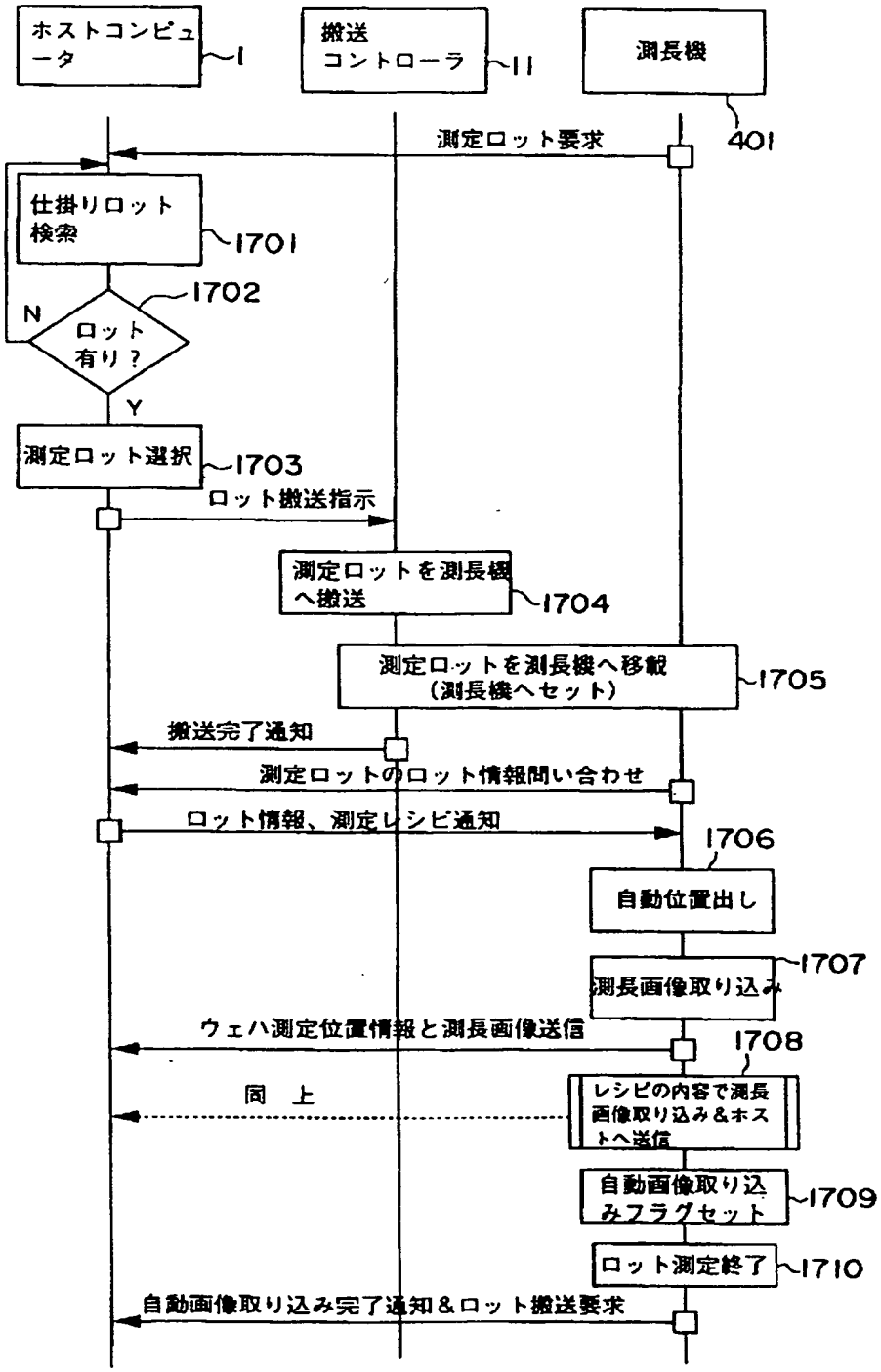
【図18】



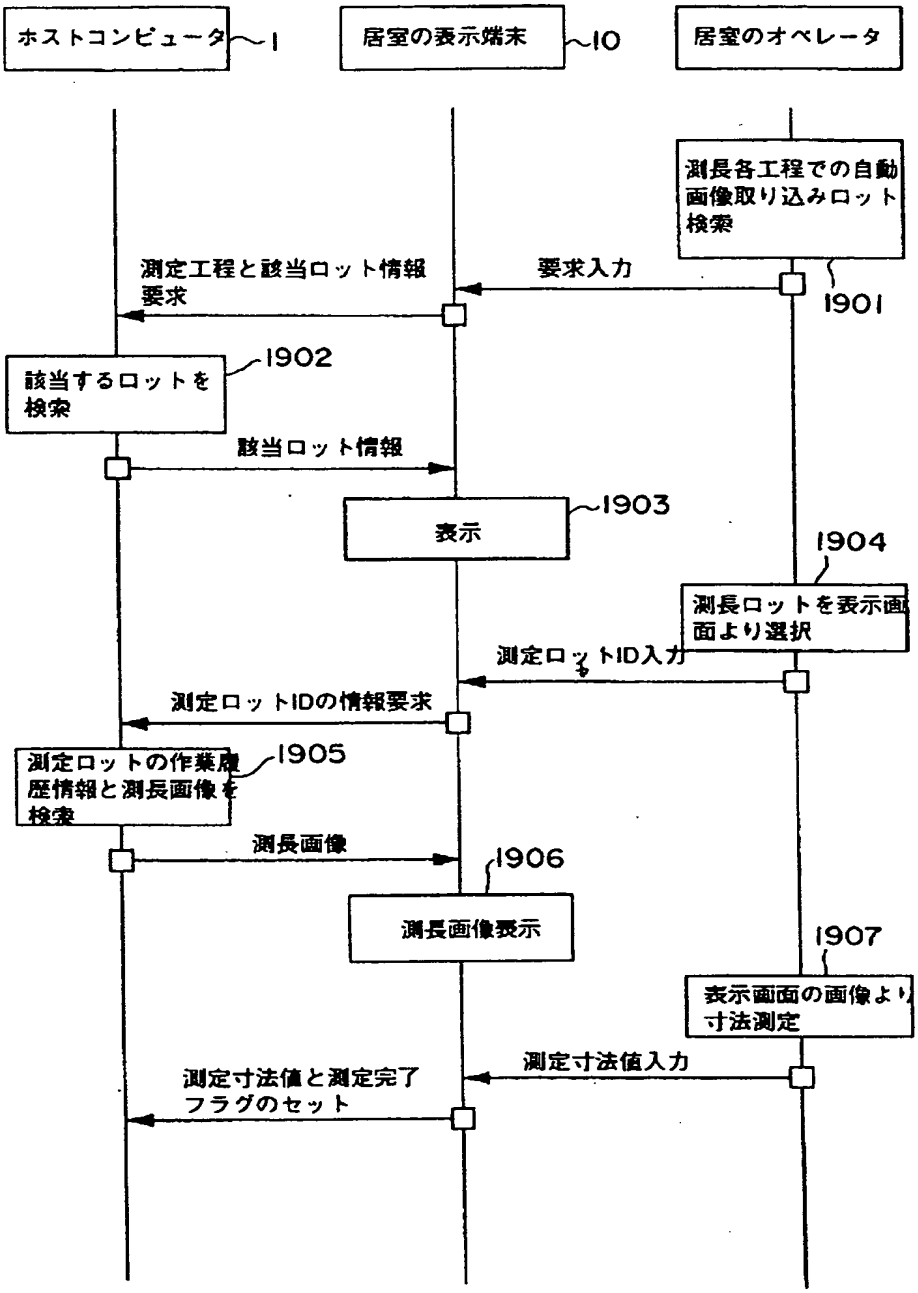
【図20】



【図17】


ホストコンピュータ
1
搬送コントローラ
11
測長機
401
測定ロット要求
仕掛りロット検索
1701
1702
N
ロット有り？
Y
測定ロット選択
1703
ロット搬送指示
測定ロットを測長機へ搬送
1704
測定ロットを測長機へ移載（測長機へセット）
1705
搬送完了通知
測定ロットのロット情報問い合わせ
ロット情報、測定レシピ通知
1706
自動位置出し
測長画像取り込み
1707
ウェハ測定位置情報と測長画像送信
1708
同　上
レシピの内容で測長画像取り込み＆ホストへ送信
自動画像取り込みフラグセット
1709
ロット測定終了
1710
自動画像取り込み完了通知＆ロット搬送要求

【図19】


ホストコンピュータ
1
居室の表示端末
10
居室のオペレータ
測長各工程での自動画像取り込みロット検索
1901
要求入力
測定工程と該当ロット情報要求
該当するロットを検索
1902
該当ロット情報
表示
1903
1904
測長ロットを表示画面より選択
測定ロットID入力
測定ロットIDの情報要求
測定ロットの作業履歴情報と測長画像を検索
1905
測長画像
1906
測長画像表示
1907
表示画面の画像より寸法測定
測定寸法値入力
測定寸法値と測定完了フラグのセット